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MODEL 2501T
AC POWER SOURCE

SOLID STATE *Invertron*®

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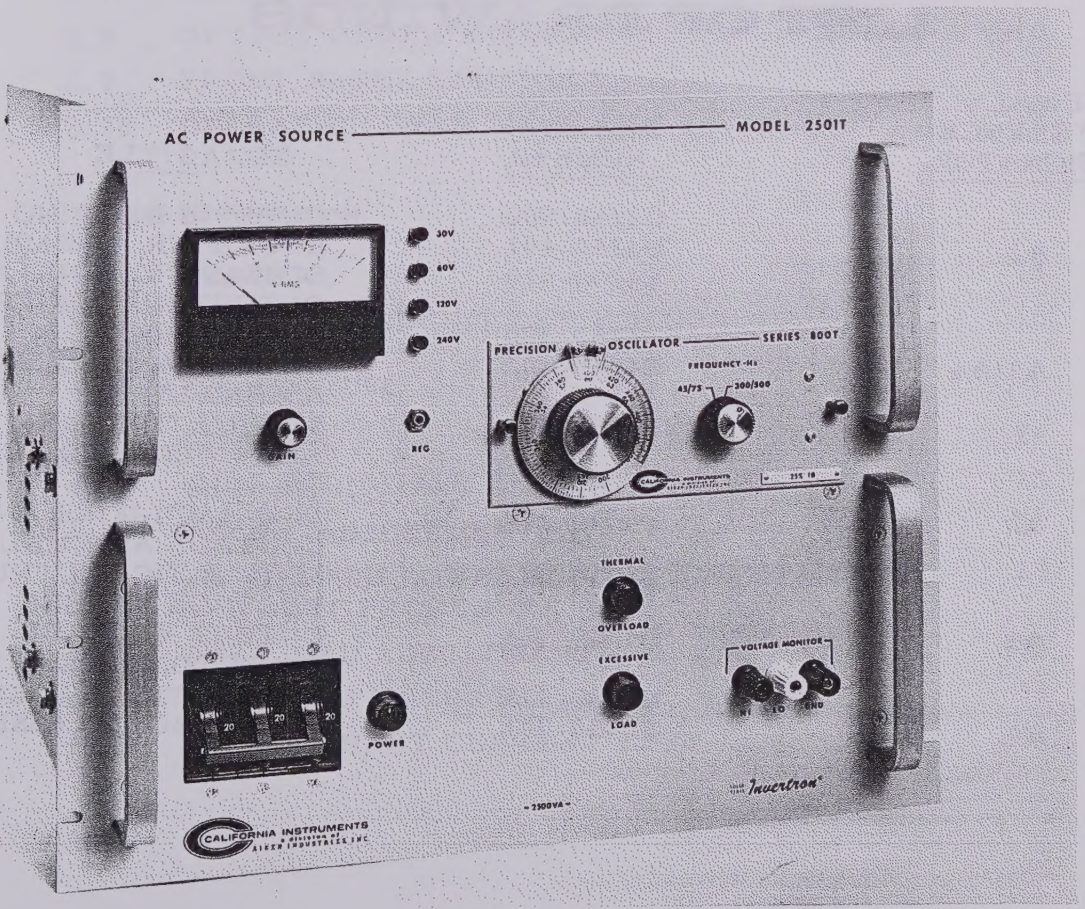
A Norlin Technology Company

Revision C
November, 1978

INSTRUCTION MANUAL

MODEL 2501T
AC POWER
SOURCE

SOLID STATE *Invertron*®



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	E4250-070	SCHEMATIC, UNIT AND OUTPUT AMPLIFIER
	E4250-400	FINAL ASSEMBLY
A3/A4	E4250-402	OUTPUT AMPLIFIER ASSEMBLY
	E4250-071	SCHEMATIC, PRE-AMPLIFIER AND CONTROL CIRCUIT
A1	D4250-700	PRE-AMPLIFIER AND CONTROL ASSEMBLY
	D4250-072	SCHEMATIC, OUTPUT VOLTAGE RANGES
A5	D4250-404	OUTPUT VOLTAGE SELECTOR ASSEMBLY
	B4050-072	SCHEMATIC, METER CIRCUIT
A6	C4050-702	METER BOARD ASSEMBLY

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SPECIFICATIONS

MODEL 2501T AC POWER SOURCE

All specifications are tested in accordance with standard California Instruments test procedures and apply with a stable, low distortion input signal as generated by a T series plug-in oscillator.

POWER OUTPUT:	2500 VA at 120 to 110 volts rms output with power factor of unity to ±0.7. See the derating chart on the following page for operation at lower voltages and/or power factor.
OUTPUT VOLTAGE RANGES: (Determined by rear loaded printed circuit assembly)	0 to 30 volts rms, 0 to 60 volts rms, 0 to 120 volts rms, and 0 to 240 volts rms.
TOTAL HARMONIC DISTORTION:	Less than 0.3% distortion at midband (200Hz to 600Hz), and less than 0.5% distortion from 45Hz to 2KHz.
AMPLITUDE STABILITY: (after one hour warm-up)	± 0.25 percent for 24 hours at constant line, load and ambient temperature conditions.
LOAD REGULATION: * (on 120 volt range)	± 1% over the range from 45Hz to 2KHz when tested at unity power factor. In addition, a load regulation adjustment permits the regulation to be adjusted to zero at any given line voltage, signal frequency and load conditions. Control resolution is 0.02%.
LINE REGULATION:	± 0.10 percent of full output for a ± 10 percent line change.
FULL POWER FREQUENCY RANGE: **	45Hz to 2KHz.
FREQUENCY RESPONSE:	± 0.5 dB from 45Hz to 2KHz.

*Load regulation degrades slightly on the 30 volt, 60 volt and 240 volt ranges for operation above 1.0KHz. See Section 4.9.5 of this instruction manual for test procedure on these ranges.

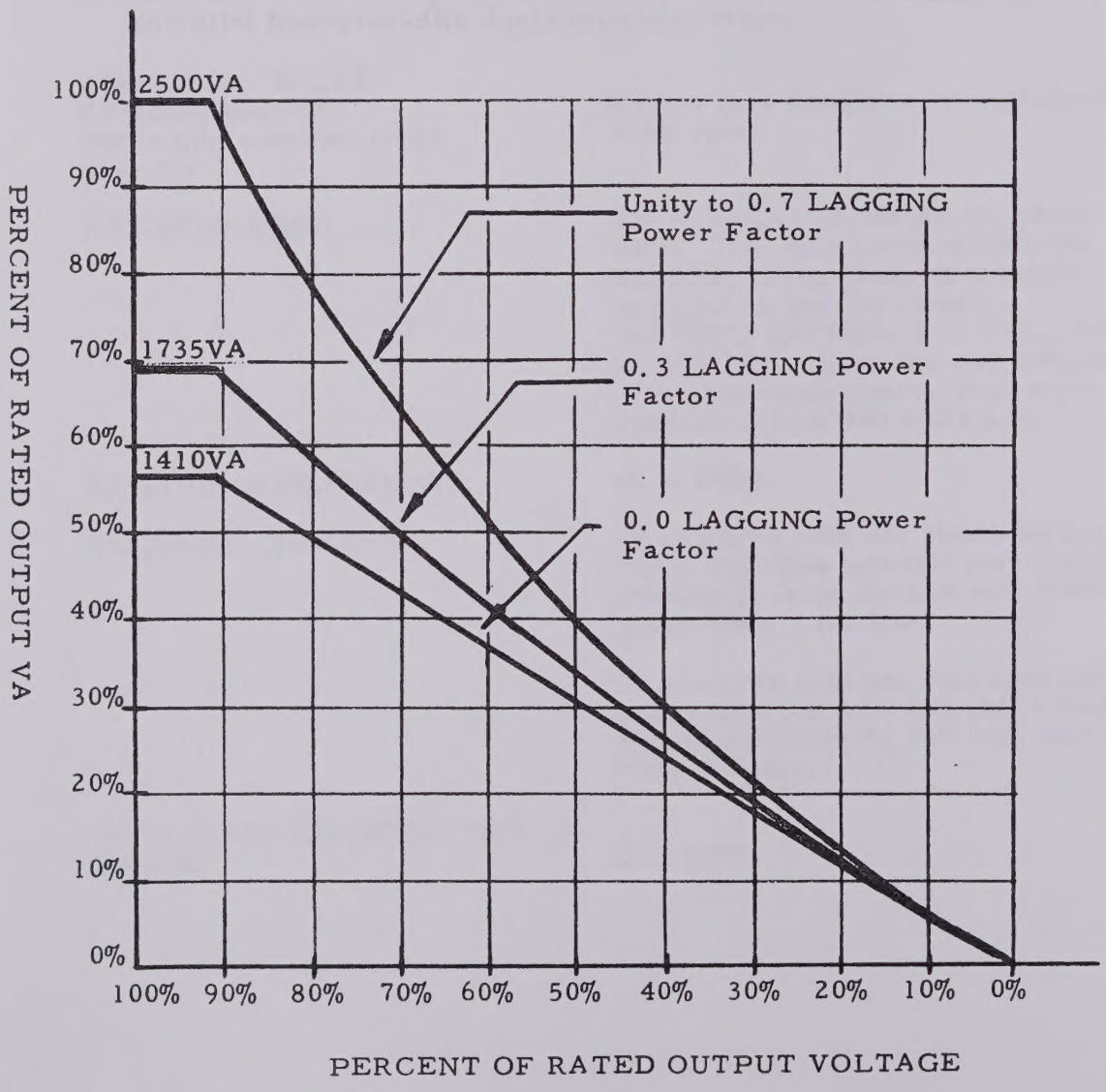
** This power source may be used over the 20Hz to 20KHz frequency range provided the output voltage and the output VA are derated according to Table 2-2 in this instruction manual; otherwise, permanent damage to the unit may occur.

AC NOISE LEVEL:	50 dB below full output while measured at full power output.
OVERLOAD AND SHORT CIRCUIT PROTECTION:	Complete protection from overloads and short circuits is provided. Automatic instantaneous reset occurs when overload is removed.
THERMAL PROTECTION:	Thermal overload circuit is activated if overload exists for a prolonged time period; if the unit is operated at an excessive ambient temperature; or if heatsink fan failure occurs. Automatic reset occurs when heatsink temperature returns to normal operating temperature.
AMPLIFIER DRIVE REQUIREMENTS: (Normally obtained from plug-in)	5 volts rms (maximum) produces 120 volts rms.
AC INPUT LINE:	208 volts L-L three phase, three wire. Unit may be wired for the following three phase three wire voltages on special order: 220 VAC, 230 VAC, 415 VAC, 440 VAC or 460 VAC. Also the unit may be wired for three phase, four wire operation from 380 volts L-L.
AC INPUT FREQUENCY:	48 to 65Hz.
AC INPUT CURRENT:	19 amperes rms per line maximum under high line and full rated load conditions from the 208 volt three phase 60Hz AC line. 20 amperes rms per line maximum under high line and full rated load conditions from the 208 volt three phase 50Hz AC line.
OPERATING TEMPERATURE RANGE:	0 to 55°C.

FRONT PANEL METER: (Meter range also controlled by rear loaded printed circuit assembly)	0 to 40, 80, 160, 320 volts AC voltmeter provides ± 1% of full scale accuracy at 400Hz and ± 3 percent of full scale accuracy over the range from 45Hz to 2KHz.
DIMENSIONS:	15.75" high x 19" wide x 21" maximum depth.
NET WEIGHT:	240 pounds.
SHIPPING WEIGHT:	250 pounds.
FRONT PANEL FINISH:	Grey, 26440 per Federal Standard 595 with black silk-screened lettering.

POWER DERATING CHART
FOR MODEL 2501T POWER SOURCE

(Applys over the range from 45Hz to 2KHz. Derate the curve for output VA by 2.0 to 1.0 factor for operation above 2KHz but less than 5KHz; Derate by 3.0 to 1.0 factor for operation from 5KHz to less than 7.5KHz; Derate by 4.0 to 1.0 factor for operation from 7.5KHz to less than 10KHz; Derate by 6.0 to 1.0 factor for operation from 10KHz to less than 15KHz; Derate by 8.0 to 1.0 factor for operation from 15KHz to 20KHz).



GENERAL DESCRIPTION

1.1 INTRODUCTION

This instruction manual contains information on the installation, operation, calibration, and maintenance of the California Instruments Model 2501T Power Source. Detailed schematics, parts location, drawings, calibration procedures, and theory of operation are also contained for the aid of maintenance personnel.

1.2 GENERAL DESCRIPTION

The California Instruments Model 2501T Power Amplifier is a solid state, high performance, low distortion power source that provides up to 2500 VA output when used with the proper plug-in oscillator. The Model 2501T Power Source is illustrated in Figure 1-1. Full power output is available in four different voltage ranges and over the frequency range from 45Hz to 2 KHz. These full power voltage ranges are:

1) 27.5 to 30 volts rms for applications where four units are to be stacked in series to provide 10KVA at 120 volts,

2) 55 to 60 volts rms for applications where two units are to be stacked in series to provide 5KVA at 120 volts,

3) 110 to 120 volts rms for normal single phase 115 volt applications and for three phase 208 volt line-to-line applications,

4) 220 to 240 rms for normal single phase 230 volt applications.

For two phase and three phase operation, at least two power amplifiers must be combined together with the applicable multi-phase oscillator. Two power amplifiers will provide a total of 5KVA two phase power, or 5KVA of three phase power in the open delta configuration. Three power amplifiers will provide 7.5KVA of three phase power in the wye configuration.

1.3 ACCESSORY EQUIPMENT

The following accessories are available for use with the California Instruments Model 2501T Power Source:

1.3.1 California Instruments Part Number 4250-221-1 rack slides. These rack slides may be bolted directly to the sides of the unit, if required.

1.3.2 Series 800T Variable Frequency Oscillators. These general purpose Wien Bridge Oscillators provide one phase, two phase or three phase outputs over the range from 20Hz to 20KHz in three bands. Units with single phase output are designated as 800T-20/20K-1-1ϕ, two phase oscillators are designated as 800T-20/20K-1-2ϕ, and three phase oscillators are designated as 800T-20/20K-1-3ϕ. Calibration accuracy is ±1 percent at 25°C and amplitude stability is .25 percent per 24 hours at 25°C. The total harmonic distortion is less than 0.25 percent from 20Hz to 20KHz. Several versions of the 800T oscillator are also available which operate over a more restricted frequency range, but which provide improved frequency resolution.

1.3.3 Series 810T Fixed Frequency Oscillators. These oscillators provide one phase, two phase or three phase output over the range from 45Hz to 10KHz. Units with single phase output are designated as 810T-Freq.-.1-1ϕ, two phase oscillators are designated as 810T-Freq.-.1-2ϕ, and three phase oscillators are designated as 810T-Freq.-.1-3ϕ. Frequency accuracy is ±0.1 percent at 25°C. Amplitude stability is ±0.01 percent per 24 hours at 25°C and varies less than .0025 percent degree centigrade. Harmonic distortion is less than 0.1 percent from 45Hz to 5KHz.

1.3.4 Series 812T Open Delta Servo Oscillators. These oscillators provide a three phase output for driving two Invertron® power sources in an open delta configuration. The Model 812T Oscillator contains two amplitude servos and one angle servo to provide a closed loop three-phase AC power system with ±0.01% line and load regulation. Units normally incorporate three front panel selectable output frequencies of 50, 60 and 400Hz. The system output voltage can be varied from 110 to 120 volts with ±0.1 percent amplitude tracking and less than 0.25 percent system distortion. Crystal controlled versions of this oscillator are available on special order.

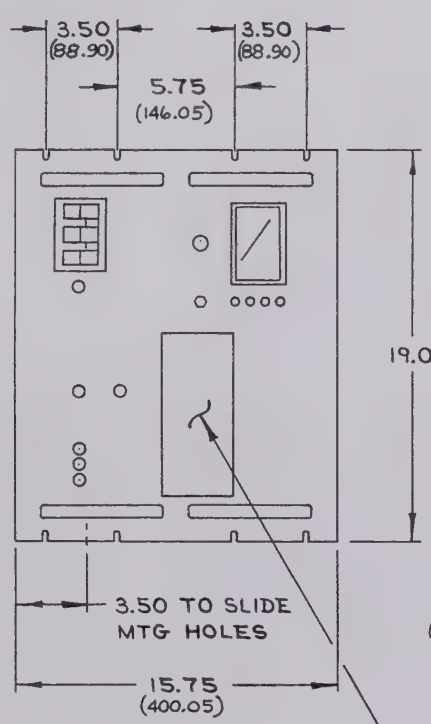
1.3.5 Series 815T Fixed Frequency Oscillators. These low-cost fixed frequency oscillators provide one phase, two phase or three phase outputs over the range from 45Hz to 10KHz. Units with single phase output are designated as 815T-Freq.-.1-1ϕ, two phase oscillators are designated as 815T-Freq-.1-2ϕ and three phase oscillators are designated as 815T-Freq-.1-3ϕ. Frequency accuracy is ±0.1 percent at 25°C. Amplitude stability is ±.25 percent per 24 hours at 25°C and varies less than 0.02 percent per degrees centigrade. Harmonic distortion is less than 0.2 percent from 45Hz to 10KHz.

1.3.6 Series 820T Fixed Frequency Crystal Oscillators. These oscillators provide one phase, two phase or three phase outputs over the range from 45Hz to 20KHz. Units with single phase output are designated as 820T-Freq-Accuracy-1ϕ, two phase oscillators are designated as 820T-Freq-Accuracy-2ϕ and three phase oscillators are designated as 820T-Freq-Accuracy-3ϕ. Frequency accuracy is ±0.01 percent or ±0.0001 percent. Amplitude stability is ±0.25 percent per 24 hours at 25°C. The total harmonic distortion is less than 0.15 percent from 200Hz to 5KHz.

1.3.7 Series 830T Programmable Oscillators. These oscillators provide one phase, two phase or three phase outputs over the range from 45Hz to 9.99KHz. These units are packaged in a separate 5-1/4 inch package which may be mounted below/above the associated power amplifier.

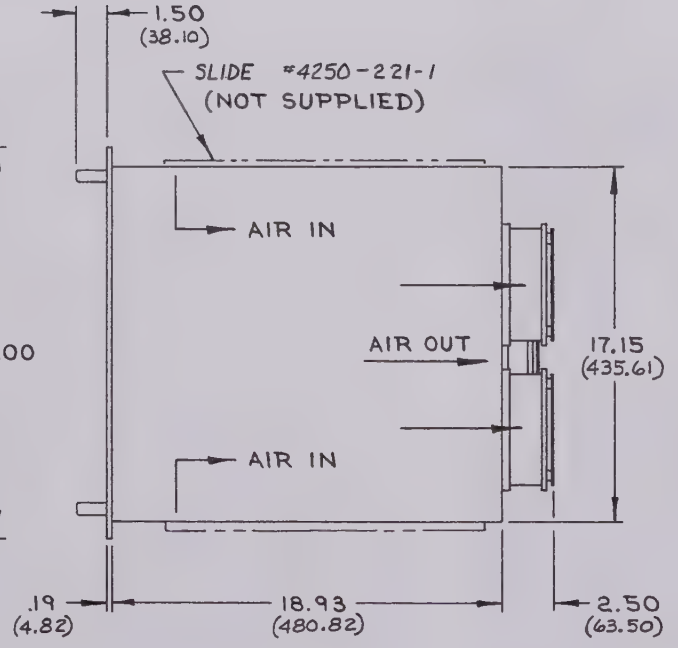
1.3.8 Series 840T Programmable Oscillators. These plug-in oscillators provide one phase, two phase or three phase output at 380, 400 and 420Hz. Frequency accuracy is ±0.1 percent of programmed value. Servo feedback is taken from the output of each phase back to the 840T Programmable Plug-in Oscillator and provides an accuracy of ±0.1 percent of programmed value.

REVISIONS						
REV	AUTH	DESCRIPTION	ZONE	EFF ON	DATE	APRD

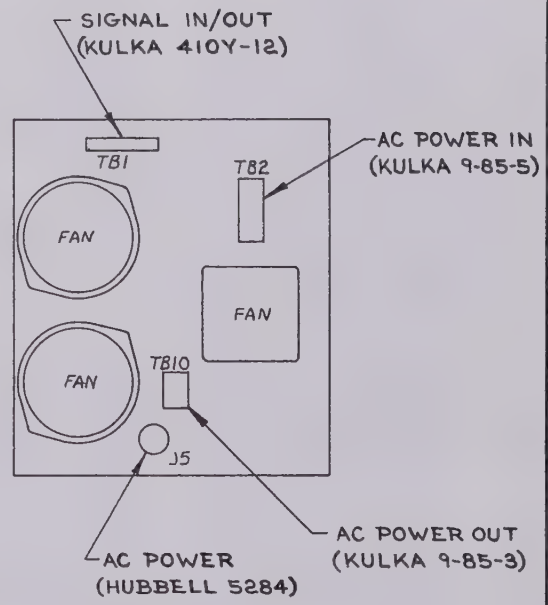


FRONT VIEW

PLUG-IN OSCILLATOR
PURCHASE SEPARATE



TOP VIEW



REAR VIEW

C4250-900 /

REQD PER ASSY	ITEM NO.	PART NUMBER	PART NAME	MATERIAL — SPECIFICATION	CODE IDENT	FINISH	REF DES.	ZONE

DIM IN INCHES
TOLERANCES
.XXX = .010
.XX = .03
X° = 30'

BREAK ALL SHARP CORNERS & EDGES
MACH SURFACES ✓

DWG SIZE C

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TITLE
OUTLINE DRAWING
2500 VA POWER SOURCE

CALIFORNIA INSTRUMENTS
A DIVISION OF AIKEN INDUSTRIES, INC.

MODEL 2501 T

CONTRACT NO.

CODE IDENT 16067

RELEASE			
CHECKER		11/20/6	PURCHASING
DESIGN			PROJ ENGR
DRFTSMN	J. LARA	10/5/73	CHF ENGR

DWG NO. C4250-900 REV /

SCALE 1/4 SHEET 1 OF 1

DASH NO.	QTY REQD	NEXT ASSEMBLY	EFF ON	AUTH

CALICO F-502

1. FRONT PANEL DIMENSIONS PER W.E./E.I.A. STD.

NOTES: (UNLESS OTHERWISE SPECIFIED)

WARNING

Voltages up to 480 VAC are available in certain sections of this power source. This equipment generates potentially lethal voltages.

DEATH

on contact may result if personnel fail to observe safety precautions. Do not touch electronic circuits when power is applied. Avoid contact with pin C and pin D of the plug-in oscillator, the primary power circuits, and the output circuits of the power source.

INSTALLATION AND OPERATION

2.1 UNPACKING

The California Instruments Model 2501T Power Source is shipped in a cardboard container with protective inner packing. Do not destroy the packing container until the unit has been inspected for possible damage in shipment.

2.2 POWER REQUIREMENTS

2.2.1 The Model 2501T Power Source has been designed to operate from any one of the following AC line voltages: 208 volts, 220 volts, 230 volts, 380 volts, 416 volts, 440 volts or 460 volts, three phase. The power transformer is normally wired at the factory for operation from the 208 volt, three phase, three wire AC line. Table 2-1 below indicates how the primary connections to the power transformer are made for various AC input line voltages.

TABLE 2-1

NOTE

Prior to reconnection power transformer T1, remove all existing jumpers from the primary winding, except those to pins 1, 10, and 19. Connect CB1, phase "A" load terminal to T1-pin 2; connect CB1, phase "B" load terminal to T1-pin 20; connect CB1, phase "C" load terminal to T1-pin 11.

Nominal Input Voltage	Operating AC Line Voltage Range	Power Transformer Connections	Front Panel Circuit Breaker Value
208 volts L-L three phase, three wire.	187.2-228.8 volts L-L	Jumper pins 2, 6, 21, and 25; jumper pins 3, 7, 11, and 15; jumper pins 12, 16, 20 and 24.	20 ampere three phase, 250 volt circuit breaker
220 volts L-L three phase, three wire.	198-242 volts L-L	Jumper pins 2, 6, 22, and 26; jumper pins 4, 8, 11 and 15; jumper pins 13, 17, 20 and 24.	20 ampere three phase, 250 volt circuit breaker.
230 volts L-L three phase, three wire.	207-253 volts L-L	Jumper pins 2, 6, 23, and 27; jumper pins 5, 9, 11, and 15; jumper pins 14, 18, 20 and 24.	20 ampere three phase, 250 volt circuit breaker.
380 volts L-L three phase, four wire.	342-418 volts L-L	Jumper pin 2 to 6; jumper pin 11 to 15; jumper pin 20 to 24; jumper pins 4, 8, 13, 17, 22 to 26 and connect to neutral of TB2 through #12 wire.	12 ampere three phase, 480 volt circuit breaker.

TABLE 2-1 cont.

Nominal Input Voltage	Operating AC Line Voltage Range	Power Transformer Connections	Front Panel Circuit Breaker Value
416 volts L-L three phase, three wire.	374.4-457.6 volts L-L	Jumper pin 2 to 25; jumper pin 3 to 6; jumper pin 7 to 11; jumper pin 12 to 15; jumper pin 16 to 20; jumper pin 21 to 24.	10 ampere three phase, 480 volt circuit breaker.
440 volts L-L three phase, three wire.	396-484 volts L-L	Jumper pin 2 to 26; jumper pin 4 to 6; jumper pin 8 to 11; jumper pin 13 to 15; jumper pin 17 to 20; jumper pin 22 to 24.	10 ampere three phase, 480 volt circuit breaker.
460 volts L-L three phase, three wire	414-506 volts L-L	Jumper pin 2 to 27; jumper pin 5 to 6; jumper pin 14 to 15; jumper pin 23 to 24; jumper pin 9 to 11; jumper pin 18 to 20.	10 ampere three phase, 480 volt circuit breaker.

2.2.2 The Model 2501T has been designed to operate over the line frequency range from 48 to 65Hz. On special order, units will be supplied to operate from the 400Hz line.

2.2.3 The normal rms input current on the 208 volt L-L range, at rated output power, is between 15 amperes and 18 amperes per leg depending on line and load conditions. During "turn-on" the peak transient will not exceed 20 amperes per leg.

2.3 CIRCUIT BREAKER REQUIREMENTS

The Model 2501T Power Source uses a 20 ampere Heinemann CF3-G3-U-20-240-3 circuit breaker for operation from the 208 through 230 volt three phase AC lines. A Heinemann CF3-G3-U-12-480-3 circuit breaker is used for operation from the 380 volt three phase four wire AC line. A Heinemann CF3-G3-U-10-480-3 circuit breaker is used for operation from the 416 through 460 volt three phase AC lines. Substitution of circuit breaker type or current rating may cause permanent damage to the unit.

2.4 OUTPUT VOLTAGE, METER RANGE, AND FRONT PANEL RANGE INDICATOR

2.4.1 The output voltage available from the Model 2501T Power Source is determined by a rear loaded printed circuit assembly. This assembly plugs into a connector set located inside the power source and accessible by removing the small plate at the rear of the unit. Rotate the printed circuit assembly until the desired output voltage range has been found and then re-insert the printed circuit assembly into the connector and replace the cover plate.

2.4.2 This assembly is also used to select the proper range for the front panel voltmeter and to illuminate the proper front panel range indicator lamp.

2.5 ACCEPTANCE TEST PROCEDURE

Inspect the unit for any possible shipping damage immediately upon receipt. If damage is evident, notify the carrier. DO NOT return an instrument to the factory without prior approval. If the unit appears in good condition, perform the following.

2.5.1 Connect the AC power input (TB2) to a three phase AC power line of the proper voltage and frequency as determined by either the serial number tag on the unit or by inspection of the wiring to the primary of the power transformer (see Section 2.2 of this instruction manual). Connect a 15KW three phase Variac and a 0 to 20 ampere true rms meter in series with each leg of the three phase AC line. The Model 2501T Three Phase Power Source should draw less than 2.0 amperes per leg under no load conditions at mid-line voltage from the 60Hz AC line. The Model 2501T Three Phase Power Source should draw less than 4.0 amperes per leg under no load conditions at mid-line voltage from the 50Hz AC line. If a problem is encountered, perform Step 4.3.2 of the CALIBRATION PROCEDURE.

2.5.2 Using either a California Instruments 800T Series Oscillator or a suitable external low distortion sine wave oscillator, set the oscillator to the desired frequency (between 45Hz and 2KHz) and adjust the output of the oscillator to 5 volts rms. The amplifier input is available at pin 2 (tie oscillator ground to pin 1) of the small terminal strip TB1 located on the rear of the unit, if the external oscillator is employed. Tie a jumper strap from pin 2 to pin 3 of TB1 if an 800T Series Plug-in Oscillator is being used as the signal source.

2.5.3 Select the proper output voltage range according to the procedure given in Section 2.4 of this instruction manual. The following table lists the proper external load for full power output on each of the voltage ranges.

Output Voltage Range	Output Voltage	Full Power Load Resistance	50 Percent Power Load Resistance
0-30 volts rms	30 volts rms	0.36 ohms	0.72 ohms
0-60 volts rms	60 volts rms	1.44 ohms	2.88 ohms
0-120 volts rms	120 volts rms	5.76 ohms	11.52 ohms
0-240 volts rms	240 volts rms	23.04 ohms	46.08 ohms

2.5.4 Connect the proper 2500 watt load resistor to the large output terminals at the rear of the power source which are labeled "POWER OUTPUT HIGH-LOW." Connect a Tektronix Model 533A Oscilloscope or equivalent across this load resistor.

2.5.5 Using the GAIN control and the proper range on the front panel METER, set the output voltage to the rated voltage of the unit as determined in Section 2.5.3 of this manual. The rms input current line meters should indicate between 15 and 17 amperes per leg at 208 volts L-L input. from the 60Hz AC line. Check on the oscilloscope for peak clipping or excessive distortion of the sine wave output.

2.5.6 With the output still adjusted as determined in 2.5.5, place a resistor in parallel with the external load resistor to provide a 50% overload on the output of the power source. The value of this resistor is given in Section 2.5.3 of this manual. The signal on the oscilloscope should exhibit significant clipping on both the positive and negative peaks.

The front panel circuit breaker may be activated if this 50 percent overload remains on the output of the 2501T for more than a few seconds. The front panel circuit breaker can not usually be immediately reset. Wait 30 seconds to one minute before attempting to reset the circuit breaker.

2.5.7 Remove the 50 percent overload resistor and the output should automatically return to normal, unless the front panel circuit breaker was activated due to the 50 percent overload.

2.5.8 Place a short circuit in parallel with the external load resistor and then remove the short circuit after one second. The signal on the oscilloscope should go to zero and then return to normal when the short circuit is removed. The front panel circuit breaker and/or thermal overload may be activated if the short circuit remains across the output for more than a few seconds.

2.5.9 The CALIBRATION PROCEDURE given in Section 4.0 of this manual should be followed if a more detailed evaluation of the unit is required at this time.

2.6 MECHANICAL INSTALLATION

The Model 2501T Power Source has been designed for rack mounting in a standard 19 inch rack. The unit should be supported from the bottom with a shelf-track or supported from the sides with a pair of rack slides (California Instruments Part Number 4250-221 or equivalent).

The cooling fans on the rear of the unit must be free of any obstructions which would interfere with the flow of air. A 2.5 inch clearance should be maintained between the rear of the fans and the rear door of the mounting cabinet. Also, the air intake holes on the sides and rear of the power source must not be obstructed.

2.7 INPUT POWER WIRING

The Model 2501T Power Source will operate from three phase input voltages from 208 volts to 460 volts L-L in seven ranges as described in Section 2.2 of this manual. The power source should be used with 208 volt three phase lines with a capacity of 20 amperes or greater. If 380 to 460 volt AC lines are used, their capacity should be 12 amperes or greater.

2.8 OUTPUT POWER WIRING

The power output wires should be large enough to avoid excessive line voltage drops. The front panel regulation control is capable of providing greater than 3 percent over regulation for all normal load conditions. If it is desired to provide a zero output impedance at the load side of the power wiring, it is necessary that these line drops be limited to approximately 1 to 3 percent of the required output voltage. The following table lists the minimum acceptable wire size for the given percent line drop, assuming a 2500 VA output at a distance of 20 feet from the power source to the load.

Output Voltage	Percent Line Drop	Maximum Line Drop	Load Current	Loop Length	Minimum Required Wire Size
30 volts	3.0%	0.9 Volts	83.33 amperes	40 feet	#4
60 volts	2.0%	1.2 Volts	41.67 amperes	40 feet	#8
120 volts	1.0%	1.2 Volts	20.83 amperes	40 feet	#11
240 volts	0.5%	1.2 Volts	10.42 amperes	40 feet	#14

The wire size should be reduced 3 sizes everytime that the distance between the power source and load is doubled, but it is limited to number four by the size of terminal block TB10. The minimum wire size is further limited by the load current according to the table below at an ambient temperature of 25°C.

LOAD CURRENT	WIRE SIZE WITH 105°C PVC INSULATION	WIRE SIZE WITH 80°C PVC INSULATION
90 amperes	#6	-
45 amperes	#10	#6
22.5 amperes	#14	#10
12.0 amperes	#18	#14

Full power output is available from the rear panel output (TB10) on all ranges of the power source. The front panel output terminals will supply full power output on the 240 volt and 120 volt ranges, but should be limited to 1500 VA and 750 VA, respectively on the 60 volt and 30 volt ranges.

2.9 FRONT PANEL CONTROLS

2.9.1 The three phase circuit breaker, located on the front panel of the Model 2501T Power Source, is used to switch the POWER to the unit "ON". At this time the amber indicator lamp located above this circuit breaker should glow.

2.9.2 The GAIN control is used to adjust the output voltage level of the power source. In the case of a multi-phase power system, the GAIN control is turned nearly fully clockwise and then used as a fine gain trim control. The amplitude of the output of the multi-phase system is controlled by the AMPLITUDE control located on the multi-phase oscillator.

2.9.3 The REG control is recessed behind the front panel and is screw driver adjustable. This control is used to vary the output impedance of the power source. Turning this control in the clockwise direction reduces the output impedance of the power source. If this control is rotated far enough in the clockwise direction, the power source will exhibit a negative output impedance and may be used to compensate for line voltage drops between the output of the power source and the load. Section 2.8 includes additional information on the possible application of this control.

2.9.4 The RANGE lamps on the front panel indicate which output voltage range, 0 to 30 volts, 0 to 60 volts, 0 to 120 volts or 0 to 240 volts is activated by the rear loaded printed circuit card. The corresponding voltmeter ranges are 0 to 40 volts, 0 to 80 volts, 0 to 160 volts and 0 to 320 volts, full scale, respectively.

2.9.5 The EXCESSIVE LOAD lamp on the front panel indicates if the power source is being loaded excessively. This lamp may be activated momentarily during start-up of a non-linear load such as an AC motor load or an incandescent lamp load.

2.9.6 The THERMAL OVERLOAD lamp on the front panel indicates if the output stage is operating at an excessive temperature. When this occurs, the output power is automatically reduced to zero. When the heatsink cools sufficiently, the output power will automatically return to its previous value.

2.9.7 The front panel circuit breaker will be activated if the power source is loaded with an excessive amount of shunt capacitive load. If shunt capacitors are used to correct the power factor of an inductive load, connect a small amount of resistance in series with the shunt capacitor. The value of this resistor should be equal to approximately 10 percent of the reactance of the shunt capacitor at the operating frequency of the system.

2.10 OPERATION OVER EXTENDED FREQUENCY RANGE

2.10.1 This power source must not be driven at signal frequencies below 20Hz or above 20KHz, otherwise permanent damage to the unit may occur. For operation in the region between 20Hz and 45Hz and for operation in the region between 2KHz and 20KHz, derate the output voltage and output power according to Table 2-2 in order to provide reliable operation of the power source.

TABLE 2-2

Output Frequency	Maximum Safe Output Voltage from single 2501T Power Source				Maximum VA Output at Maximum Safe Output Voltage with ±0.7 Power Factor Load.
	30 Volt Range	60 Volt Range	120 Volt Range	240 Volt Range	
20Hz	13.3V	26.7V	53.3V	107V	850 VA
30Hz	20V	40V	80V	160V	1500 VA
40Hz	26.7V	53.3V	107V	213V	2375 VA
45Hz to 2KHz	30V	60V	120V	240V	2500 VA
greater than 2KHz but less than 5KHz	15V	30V	60V	120V	500 VA
5KHz to less than 7.5KHz	10V	20V	40V	80V	200 VA
7.5KHz to less than 10KHz	7.5V	15V	30V	60V	100 VA
10 KHz to less than 15KHz	5.0V	10V	20V	40V	46 VA
15KHz to 20KHz	3.75V	7.5V	15V	30V	22 VA

THEORY OF OPERATION

3.1 GENERAL

The California Instruments Model 2501T Power Source is an all silicon solid state 2500 VA amplifier and with companion oscillator is designed to provide reliable sine wave AC power over the frequency range from 45Hz to 2KHz.

A block diagram for the amplifier is shown in Figure 3-1. The pre-amplifier A1G1 is used to amplify the input signal to such a level so as to supply adequate drive to the power amplifier A1G2.

The power amplifier A1G2 provides the necessary sine wave signal to drive the output transformer T2. The output transformer has floating secondary windings which allow the load to float from the amplifier and oscillator circuitry.

The power amplifier A1G2 contains the overload and short circuit protection circuitry. A local negative feedback loop is taken from the output of the power amplifier back to the pre-amplifier, A1G1.

The overall negative feedback is taken from the feedback winding of the output transformer back to one input of the pre-amplifier via resistors A1R2, A1R4 and capacitor A1C2. This feedback provides a closed loop gain of 8.5 from the high side of A1R1 to the primary of T2.

The positive feedback signal is generated by sensing the IR drop across the primary of T2 and applying this signal to transformer A1T1. Transformer A1T1 converts this differential signal into a single-ended signal and applies it to the input of the pre-amplifier through a divider network containing the regulation control R9. As this positive feedback is increased from zero with potentiometer R9, the output impedance of the power source is reduced toward zero.

The multiple secondary of transformer T2 is inner connected by means of a set of rear loaded printed circuit boards, assembly A5. The rotation of this assembly is used to determine the output voltage range of the power source. This assembly also controls the front panel range lights and the range of the front panel voltmeter.

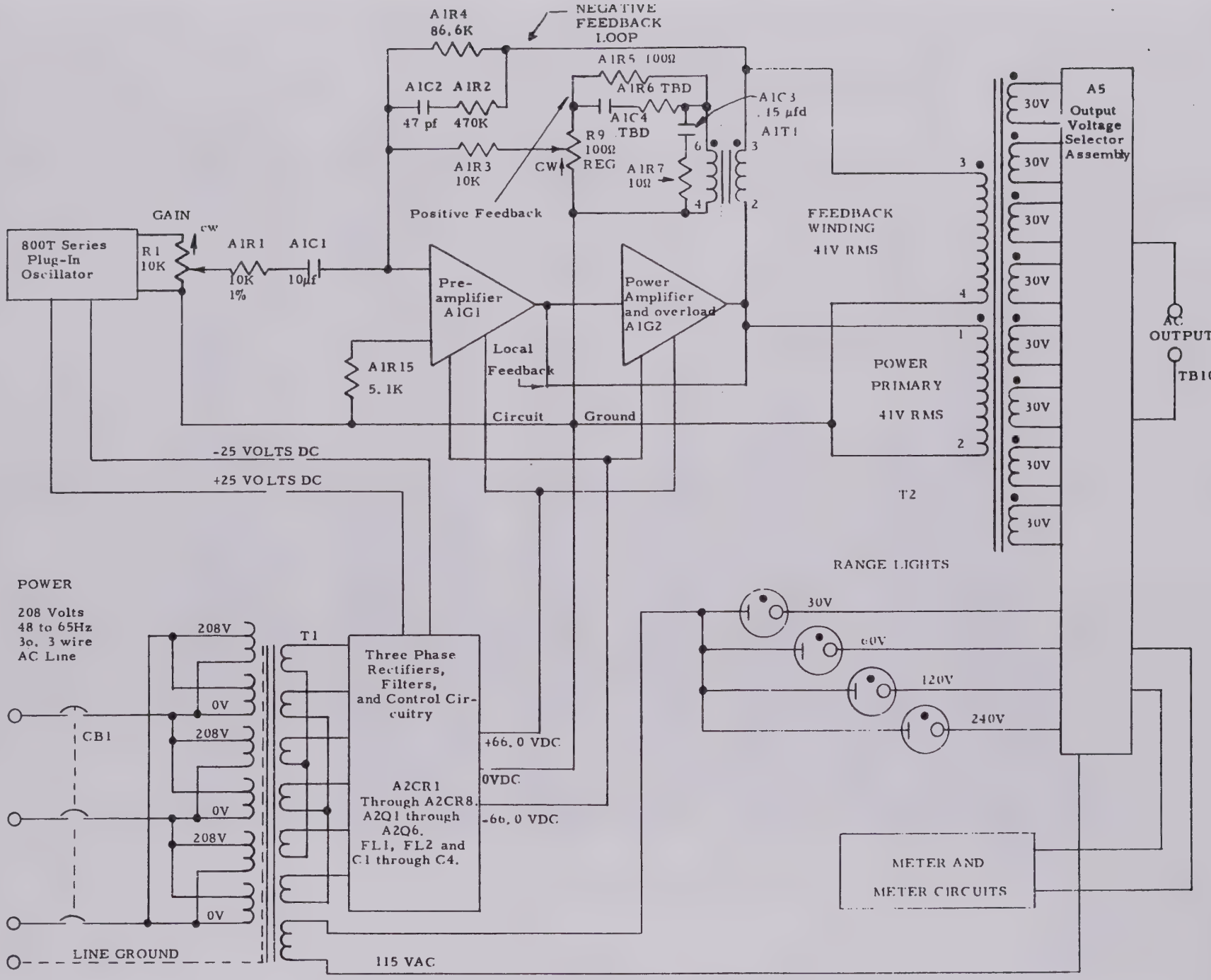


FIGURE 3-1. BLOCK DIAGRAM FOR MODEL 2501T POWER SOURCE

Power transformer T1, along with the associated silicon controlled rectifiers, filters, and control circuitry provide a regulated +66 volts and a regulated -66 volts, each at currents up to 33 amperes DC. This power supply is used to provide the operating voltages for the plug-in oscillator, the pre-amplifier A1G1, and the output amplifier A1G2.

3.2 DETAILED CIRCUIT DESCRIPTION

A schematic diagram for the Model 2501T Power Source is shown in Drawing E4250-070, with the exception of the circuitry contained on the pre-amplifier and control circuit board (assembly A1), the meter board (assembly A6), the output voltage range selector board (assembly A5), and the plug-in oscillator. A schematic for the pre-amplifier and control circuit board is given in Drawing E4250-071 and a schematic for the meter circuit is given in Drawing B4050-072. A schematic for the range selector board is given in Drawing D4250-072. For information on the plug-in oscillator, consult the applicable oscillator manual. These drawings give typical voltage levels and waveforms for the various sections of the power source.

3.2.1 PRE-AMPLIFIER

The pre-amplifier A1G1 is a part of the A1 assembly and consists of transistors A1Q1 through A1Q3 and associated components connected as a direct coupled differential amplifier. The open loop gain of this pre-amplifier is approximately 40 at 400Hz and rolls off at 6 dB per octave from 1.0 to 7.5KHz.

Transistor A1Q1 contains five transistors in one package, three npn devices and two pnp devices. Transistors A1Q1A and A1Q1B are connected so as to form a differential amplifier whose voltage gain is approximately 20 at 400Hz. Capacitor A1C7 and resistor A1R11 provide a high frequency step roll off from 1.0KHz to 7.5KHz. Potentiometer A1R13 is used to adjust the DC bias at the power primary of T2 to zero volts with no signal. Transistor A1Q1C and resistor A1R16 are connected so as to provide a current of approximately 2.0 milliamperes to A1Q1A and A1Q1B.

Transistors A1Q1D and A1Q1E are connected so as to form a differential amplifier whose voltage gain is approximately 1.0. Their primary function is to act as level shifters and to provide a phase inversion.

Transistors A1Q2 and A1Q3 are connected so as to form a differential amplifier whose voltage gain is approximately 2.0. The output of A1Q3 is used to drive transistor A1Q4.

3.2.2 POWER AMPLIFIER

The power amplifier consists of transistors A1Q4 through A1Q9 located on the A1 assembly, transistors A3Q1 through A3Q17 located on the A3 heatsink assembly, and transistors A4Q1 through A4Q17 located on the A4 heatsink assembly.

Transistor A1Q4, resistors A1R29, A1R32, A1R34, and diodes A1CR3, A1CR4 and A1CR5 are used to provide DC bias for the power output stage. This allows the output stage to operate as a Class A amplifier for no load or low VA load conditions and to operate nearly as a Class B amplifier for large load conditions.

Transistors A1Q4 and associated components are connected in the grounded emitter configuration. Local negative feedback is provided by A1C8, A1C9, A1C12, A1R27 and A1R28. The local feedbacks limits the gain of this stage to 40 at 400Hz. The gain falls off at 6 dB per octave from 7.5Hz to 200KHz.

The positive polarity output amplifier is contained on the A3 assembly and consists of A3Q1 through A3Q17 connected as emitter followers. These transistors supply a total of 97 amperes peak during the positive one-half cycle of the output waveform when the power source is loaded to 2500 VA output at 91.6 percent of rated output voltage (worst case condition within specification limits). These positive output amplifier transistors and their associated heatsinks can dissipate over 1200 watts with less than a 55°C case temperature rise with an air flow of 120 cfm per heatsink assembly.

The negative polarity output amplifier is contained on the A4 assembly and consists of A4Q1 through A4Q17 connected in the quasi-complementary symmetry configuration. These transistors supply a total of 97 amperes peak during the negative one-half cycle of the output waveform when the power source is loaded to 2500 VA output at 91.6 percent of rated output voltage (worst case condition within specification limits). These negative output amplifier transistors and their associated heatsinks can dissipate over 1200 watts with less than a 55°C case temperature rise with an air flow of 120 cfm per heatsink assembly.

When the power source is delivering its full rated output voltage the primary of the output transformer has an 41.0 volt rms signal.

3.2.3 OVERLOAD PROTECTION

The overload protection circuitry is shown in Drawing E4250-071 and consists of A1Q5, A1Q6 and associated components.

Transistor A1Q5 and associated components are connected as a clamp circuit which is used to protect the positive polarity output amplifier (assembly A3) during periods of overload or short circuit. This is accomplished be sensing the voltage at the base of A3Q3 and applying it to the emitter-base junction of A1Q5 through a suitable attenuator network. During periods of overload, the emitter-base junction of A1Q5 is forward biased sufficiently to allow the collector circuit of A1Q5 to conduct a significant portion of the base drive normally available to A1Q7. This, in turn, limits the base drive to A3Q1 and hence limits the available current from the positive polarity output amplifier during periods of overload. Potentiometer A1R48 is used to set the current level where the overload protection circuit is activated.

Transistor A1Q6 and associated components are used in a similar fashion to protect the negative polarity output amplifier (assembly A4). The only differences are that the control voltage for A1Q6 is sensed across A4R18 and potentiometer A1R46 is used to set the overload current level.

The rated VA output of the power source is, to a large extent, determined by the power dissipation in the quasi-complementary symmetry output stage. This power dissipation is determined by the power factor of the load, the output VA level of the amplifier, and to the actual output voltage expressed as a percentage of the rated output voltage. The derating chart, given in the specifications, expresses this derating in a graphical form.

The design of the overload circuitry is such that the overload level is determined by the same three parameters that determine the power dissipation in the class B output stage. Resistors A1R38, A1R41, A1R42, A1R43, A1R44 and A1R45 have been selected so that the overload protection circuit and the power factor derating chart track one another quite closely in the region between 0 volts output and 91.6 percent of rated output voltage. In the region between 91.6 percent of rated output voltage and 100 percent of rated output voltage, the rated VA output of the power source is limited by an arbitrary rating and as a result, the overload circuit allows a somewhat greater power output than that specified for the power source. The unit will be reliable in this mode of operation; however, output distortion and/or other specifications may be excessive.

3.2.4 EXCESSIVE LOAD INDICATOR LAMP

The front panel excessive load indicator lamp is activated by transistor A1Q9 and associated components. The emitter-base junction of A1Q9 is driven from the voltage developed at the base of A3Q3 through a suitable attenuator network. Potentiometer A1R55 is adjusted at the factory so that the excessive load lamp DS2 is activated at the same time that the overload protection transistors A1Q5 and A1Q6 are activated.

3.2.5 OVERALL NEGATIVE FEEDBACK

The overall negative feedback loop is a single-ended operational feedback loop taken from the negative feedback winding of T2 back to the base of A1Q1A. The feedback network consists of A1R2, A1R3, A1R4 and A1C2 and limits the mid-band closed loop voltage gain of the amplifier to 8.5 from the input side of A1R1 to the primary T2.

This overall feedback loop provides approximately 40 dB of negative feedback over the range from 45Hz to 1.0KHz. The feedback rolls off at approximately 6 dB per octave for frequencies greater than 1.0KHz. The purpose of this feedback loop is to insure that the frequency response, distortion, gain and amplitude stability specifications are met and/or exceeded.

A low frequency negative feedback loop is taken from the power primary winding of T2 back to the base of A1Q1A via A1R116 and A1R117. This loop limits the closed loop voltage gain of the amplifier to 2.7 at DC and thereby provides improved DC bias stability for the amplifier.

3.2.6 POSITIVE CURRENT FEEDBACK

The positive current feedback loop generates a positive feedback voltage proportional to the load current in the secondary of T2. This is accomplished in the following fashion:

The load current in the secondary of the output transformer T2 is reflected back into the power primary winding producing an IR drop across the power primary winding. The negative feedback winding is connected so as to buck out the $L\frac{di}{dt}$ drop in the power primary winding. The remaining differential signal is applied to the primary of transformer A1T1 and converted into a single-ended signal at the secondary of A1T1. This signal is then applied to the base of A1Q1A through a divider network consisting of A1R3, A1R5, A1R6, A1R7, R9, A1C3 and A1C4. Potentiometer R9, which is accessible from the front panel of the unit, is used to adjust the amount of positive feedback and thereby adjust the output impedance of the power source.

3.2.7 DC POWER SUPPLY

The DC Power Supply output voltage is regulated by means of the phase controlled SCR regulator shown in Drawing E4250-070. The positive supply consists of diodes A2CR1, A2CR2, A2CR3, A2CR4, and silicon controlled rectifiers A2Q1, A2Q2, A2Q3, and filter reactor FL1 and filter capacitors C1 and C3. This supply provides +66.0 volts ±2 percent across capacitors C1 and C3 at currents up to 33 amperes DC for a ±10 percent variation in the magnitude of the three phase incoming line. The ripple on the output of the +66 volt supply varies from 1.5 volts peak-to-peak to 6.0 volts peak-to-peak at full power output depending on the frequency of the output power in relation to the frequency of the incoming AC line. If, for example, the system output frequency is 1000Hz and the incoming line frequency is 60Hz, then the power supply ripple will be in the order of 1.5 volt peak-to-peak at six times the line frequency, or in this case, 360Hz. If the system output frequency is 45Hz and the incoming line frequency is 60Hz, then the power supply ripple will be in the order of 6 volts peak-to-peak and primarily at the system output frequency, or in this case, 45Hz.

Ripple at twice the incoming line frequency can be generated if the line-to-line voltages provided to the input of the power transformer T1 are not all equal to one another.

The negative supply provides -66.0 volts ±2 percent across capacitors C2 and C4 at current up to 33 amperes DC for a ±10 percent variation in the magnitude of the incoming AC line. The ripple magnitude and ripple frequency are similar to that previously described for the positive DC power supply.

The control signals for driving the gates of the SCR's are provided by the pre-amplifier and control board, assembly A1.

3.2.8 POWER SUPPLY CONTROL CIRCUIT

The power supply control circuit is used to drive the phase controlled SCR's located on the A2 assembly. A schematic for the control circuit is given in Drawing E4250-071 and consists of integrated circuits A1IC1 through A1IC17, pulse coupling transformers A1T2 through A1T7 and associated components.

The operation of the +66 volt control circuitry is described below:

a) Integrated circuits A1IC2, A1IC3 and A1IC4 are used to generate square wave signals whose zero crossings coincide with those of the phase A, phase B and phase C voltages available at the secondary of transformer T1. The negative going edges of these square wave signals are used to trigger integrated circuits A1IC5 through A1IC10 via RC differentiating networks.

b) Integrated circuits A1IC5, A1IC6 and A1IC7 are each connected so as to form pulse width modulators. These pulse width modulators provide a positive polarity pulse output, at pin 3, upon receipt of the negative polarity trigger pulse. The width of these pulses is modulated by the voltage available at pin 6 of the error integrator A1IC1. When the output voltage of the error integrator becomes more positive, then the width of the pulse increases, which in turn, delays the trigger pulse to the drivers A1IC11, A1IC12, and A1IC13. The delay time can be varied from approximately 0.3 milliseconds to 7.5 milliseconds with the pulse width modulator.

c) Integrated circuits A1IC11, A1IC12 and A1IC13 provide the power required to drive SCR's A2Q1, A2Q2 and A2Q3, respectively via coupling transformers A1T2, A1T3 and A1T4. The output pulses, available at pin 3 of A1IC11, A1IC12, and A1IC13, are each approximately 40 microseconds wide and have a magnitude of 14 volts.

d) The DC reference voltage for the error integrator is provided by resistors A1R65, A1R66, A1R67 and the +15.0 volt supply. Capacitor A1C19 is used to delay the reference voltage to the error integrator with initial application of DC power to the A1 assembly.

Capacitor A1C19 also delays DC power to pin 4 of the drivers A1IC11, A1IC12 and A1IC13 with initial application of DC power to the A1 assembly. This, in turn, inhibits the drivers for approximately 100 milliseconds and allows transients to settle before SCR A2Q1, A2Q2, and A2Q3 are allowed to fire.

e) The +15.0 volt supply is provided by diodes A1CR10, A1CR11, and A1CR22, along with capacitor A1C45 and integrated circuit regulator A1IC18. This supply develops rated output voltage immediately when power is first applied to the Model 2501T and supplies the required power to operate the SCR drive circuitry.

f) The thermal overload switches, mounted on the A3 and A4 assemblies are closed at a heat sink temperature of approximately 105°C. This drives pin 4 of A1IC11 through A1IC16 to zero volts which inhibits all drive pulses to the SCR's. When the heat sink temperature drops below approximately 90°C, the thermal overload switch opens, which allows A1C19 to charge back to its nominal value of 9.0 volts. This allows the +66 and -66 volt supplies to return to their nominal values in a "soft" fashion.

g) The output of the +66 volt supply is divided through resistors A1R62 and A1R64 and then applied to the non-inverting input of the error integrator via potentiometer A1R63. Potentiometer A1R63 is used to set the output voltage of the +66 volt supply to exactly +66 volts ±0.1 volt DC.

The operation of the -66 volt supply is similar to that of the +66 volt supply, except the output voltage is adjusted to -66 volts ±0.1 volt DC with potentiometer A1R101.

3.2.9 FRONT PANEL METER

The front panel meter M1 has a full scale sensitivity of 0 to 1 milliampere DC and an internal resistance of approximately 100 ohms. The meter has four scales with full scale ranges of 0 to 40 volts AC, 0 to 80 volts AC, 0 to 160 volts AC and 0 to 320 volts AC. The meter rectifiers and scaling circuitry are mounted on the rear of the meter.

The meter circuitry is designated as the A6 assembly and is shown in Drawing B4050-072. This circuitry consists of rectifier diodes A6CR1 through A6CR4, potentiometer A6R1 and associated components. The four rectifier diodes are connected so as to form a full wave bridge rectifier. Potentiometer A6R1 is used to shunt a small portion of the meter current and provide a sensitivity adjustment on the 40 volt scale. Resistors A6R3, A6R4 and A6R5 are selected at the factory to provide proper tracking on the 320 volt, 160 volt and 80 volt ranges, respectively.

The meter range is automatically switched with the rotation of the rear loaded range assembly. The 40 volt full scale range of the meter is used with the 0-30 volt range of the power source, the 80 volts full scale range of the meter is used with the 0 to 60 volt range of the power source, the 160 volt full scale range of the meter is used with the 0 to 120 volt range of the power source, and the 320 volt full scale range of the meter is used with the 0 to 240 volt range of the power source.

3.2.10 OUTPUT VOLTAGE RANGE

The output voltage range is controlled by the rotation of printed circuit board assembly A5. A schematic for this printed circuit board is shown in Drawing D4250-072. The primary purpose of this printed circuit board is to interconnect the multiple secondary windings of T2 in various fashions depending on the desired output voltage range. Table 3-1 below illustrates this interconnection.

TABLE 3-1

OUTPUT VOLTAGE RANGE	INTERCONNECTION
0 to 30 volts rms	S1, S2, S3, S4, S5, S6, S7, and S8 are all connected in parallel to provide the 0 to 30 volt output.
0 to 60 volts rms	S1, S2, S5, and S6 are connected in parallel; S3, S4, S7 and S8 are connected in parallel. These two combinations are connected together in the series aiding configuration to provide the 0 to 60 volt output.
0 to 120 volts rms	S2 is in parallel with S1; S4 is in parallel with S3; S6 is in parallel with S5; S8 is in parallel with S7. S1, S3, S5, and S7 are connected in the series aiding configuration to provide the 0 to 120 volt output.
0 to 240 volts rms	S1, S2, S3, S4, S5, S6, S7, and S8 are connected in the series aiding configuration to provide the 0 to 240 volt output.

WARNING

Voltages up to 480 VAC are available in certain sections of this power source. This equipment generates potentially lethal voltages.

DEATH

on contact may result if personnel fail to observe safety precautions. Do not touch electronic circuits when power is applied. Avoid contact with pin C and pin D of the plug-in oscillator, the primary power circuits, and the output circuits of the power source.

CALIBRATION PROCEDURE

4.1 GENERAL

The following calibration procedure, or any part of it, may be performed on a routine basis to insure that the Model 2501T Power Source remains within specified tolerances. This procedure should always be performed after any repairs have been made to the unit. Figure 4-2 shows the location of internal test points and adjustment potentiometers. This procedure also covers test methods for the following power source adjustments and specifications:

a) Initial Adjustments.

b) Regulated Power Supply Adjustments.

c) Overload Adjustment.

d) Harmonic Distortion.

e) AC Line Input Current.

f) Line Regulation.

g) Load Regulation Adjustment.

h) Amplitude Stability.

i) Frequency Response.

j) AC Noise Level.

k) 0.7 Lagging Power Factor.

l) 0.7 Leading Power Factor.

This calibration procedure assumes that the power source will be operated from the 208 volt 48 to 65Hz three phase, three wire AC line. For 370 volts or higher values of AC line voltage, a 480 volt variac must be substituted for that called out in this procedure. Consult Section 2.2.1 of this instruction manual for operation from other than the 208 volt AC line.

This calibration procedure further assumes that the power source is tested on the 0 to 120 volt range. Performance is very similar on the other three ranges. The following table illustrates the change in measurement voltage and impedance level when evaluating the power source on various output voltage ranges.

TABLE 4-1

Rated Output Voltage	30 VAC	60 VAC	120 VAC	240 VAC
91.6% of Rated Output voltage	27.5 VAC	55.0 VAC	110 VAC	220 VAC
Resistance Load for 2500 VA Output at Rated Output Voltage	0.36 Ω	1.44 Ω	5.76 Ω	23.04 Ω
Resistance Load for 2500 VA Output at 91.6% of Rated Output	0.303 Ω	1.21 Ω	4.84 Ω	19.36 Ω

Section 2.4 of this instruction manual indicates the procedure required to change output voltage ranges and Section 2.8 indicates some potential problems associated with output wiring IR drop on the low voltage ranges. When checking load regulation and amplitude stability, care should be taken to use a four-wire connection such that the external load and the measurement equipment have completely separate wiring from the large AC output terminal strip located at the rear of the power source.

4.2 TEST EQUIPMENT REQUIRED

The following test equipment is required to perform the calibration procedure assuming that the three phase input line voltage has a nominal value of 208 volts L-L and that the power source is tested on the 0 to 120 volt range. Some equipment substitutions will be required if this is not the case.

a) Oscilloscope, Tektronix 533A with "W" plug-in.

b) 15 KVA Variac, General Radio 3XW50M or equivalent.

c) True Rms voltmeter, H.P. 3400A or equivalent.

d) Three 0.1 ohm ±1% watt resistors, Dale Type.

e) Distortion Analyzer, H.P. or equivalent.

f) Differential Voltmeter, Fluke 883A or equivalent.

g) Multi-range 2500 watt load box, or individual 2500 watt power resistors, as defined in Table 4-1. Dale Type NHL or equivalent.

h) Expanded Scale (about 115 VAC) strip chart recorder, Voltron Model 89.038 or equivalent.

i) Multimeter, Simpson 260 or equivalent.

4.3 INITIAL ADJUSTMENTS

4.3.1 Connect the Model 2501T Power Source as shown in Figure 4-1. Turn the GAIN control fully counter-clockwise. Adjust the line voltage to its nominal value with the three phase variac. Turn the POWER switch "on". The line current meters should each indicate 2.0 amperes (0.20 volt across 0.1 ohm) or less at nominal line voltage when operating from the 60Hz AC line and 4.0 amperes or less when operating from the 50Hz AC line. If a problem is encountered, perform step 4.3.2 below.

4.3.2 Remove the top cover from the unit and check the -66 volt supply by connecting the differential voltmeter from A1TP6 (high side) to A1TP1 (common). Adjust potentiometer A1R101 if the -66 volt supply is not -66 volts ±0.5 volt. The -66 volt supply should be adjusted first as there is an interaction with the +66 volt supply.

Check the +66 volt supply by connecting the differential voltmeter from A1TP5 (high side) to A1TP1 (common). Adjust potentiometer A1R63 if the +66 volt supply is not +66 volts ±0.5 volt.

Connect the differential voltmeter between test points A1TP4 and A1TP1. Adjust the potentiometer A1R13 so that the DC voltage across the primary of the output transformer T2 is 0.00 volts ±5 millivolts DC. This balances and minimizes the collecor current in both halves of the output stage.

4.3.3 Connect the differential voltmeter to the power output terminals at the rear of the unit and select the 0 to 30 volt range with the rear loaded printed circuit assembly. Adjust the GAIN control for a 30 volt output with the oscillator set to 400Hz. Adjust the meter calibration control A6R1 so that the front panel meter and the differential voltmeter correlate within one percent of each other. Vary the frequency from 45Hz to 2KHz and check that the front panel meter reads within ±3 percent of the correct value.

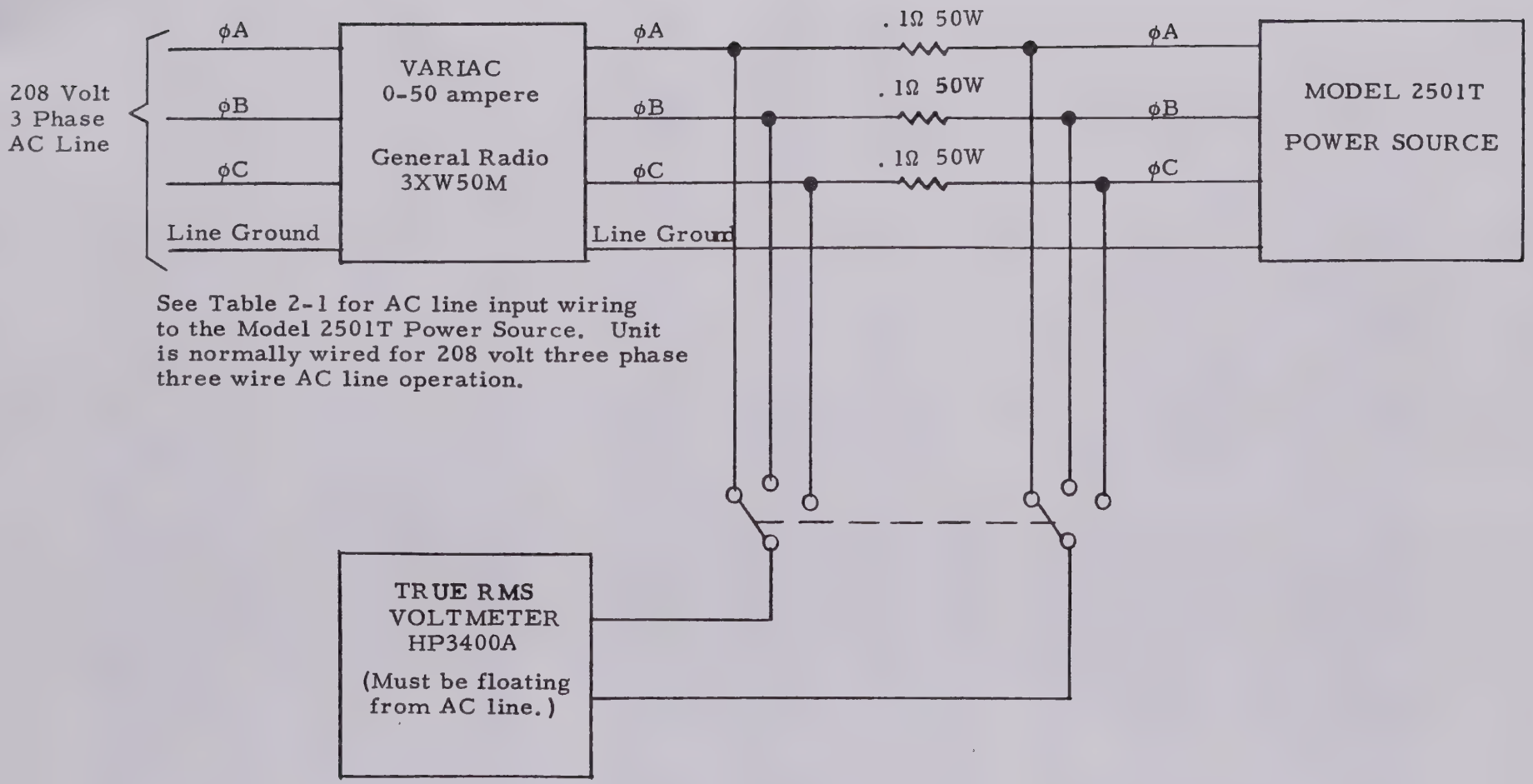


FIGURE 4-1. Test Circuit for initial adjustment of Model 2501T Power Source.

4.3.4 Remove power from the unit and select the 0 to 60 volt range with the rear loaded printed circuit assembly. Set the oscillator to 400Hz and adjust the output to exactly 60 volts while reading the differential voltmeter. Select resistor A6R5 so that the front panel meter and the differential voltmeter correlate within one percent. Vary the frequency from 45Hz to 2KHz and check that the front panel meter reads within ±3 percent of the correct value.

4.3.5 Remove power from the unit and select the 0 to 120 volt range with the rear loaded printed circuit assembly. Set the oscillator to 400Hz and adjust the output to exactly 120 volts while reading the differential voltmeter. Select resistor A6R4 so that the front panel meter and the differential voltmeter correlate within one percent. Vary the frequency from 45Hz to 2KHz and check that the front panel meter reads within ±3 percent of the correct value.

4.3.6 Remove power from the unit and select the 0 to 240 volt range with the rear loaded printed circuit assembly. Set the oscillator to 400Hz and adjust the output to exactly 240 volts while reading the differential voltmeter. Select resistor A6R3 so that the front panel meter and the differential voltmeter correlate within one percent. Vary the frequency from 45Hz to 2KHz and check that the front panel meter reads within ±3 percent of the correct value.

4.4 REGULATED POWER SUPPLY ADJUSTMENT AND TEST PROCEDURE

4.4.1 Connect the Model 2501T Power Source as shown in Figure 4-3. Select the 120 volt range and adjust the output voltage of the power source so as to provide 110 volts rms (91.6 percent of rated output voltage) at 400Hz. Close switch S2 (4.84 ohm load) so that the power source is delivering 2500 VA to the external load. Set the three phase input voltage to its nominal value (208 volts L-L in this case).

4.4.2 Set the -66 volt supply to -66.0 volts ±0.10 volt with potentiometer A1R101 under full-load conditions as defined in step 4.4.1 above.

4.4.3 Set the +66 volt supply to +66.0 volts ±0.10 volt with potentiometer A1R65 under full-load conditions as defined in step 4.4.1 above.

4.4.4 Vary the three phase input line voltage from 187.2 volts L-L (-10 percent) to 228.8 volts L-L (+10 percent) and check that the +66 volt and -66 volt supplies each vary less than ±0.25 volt DC.

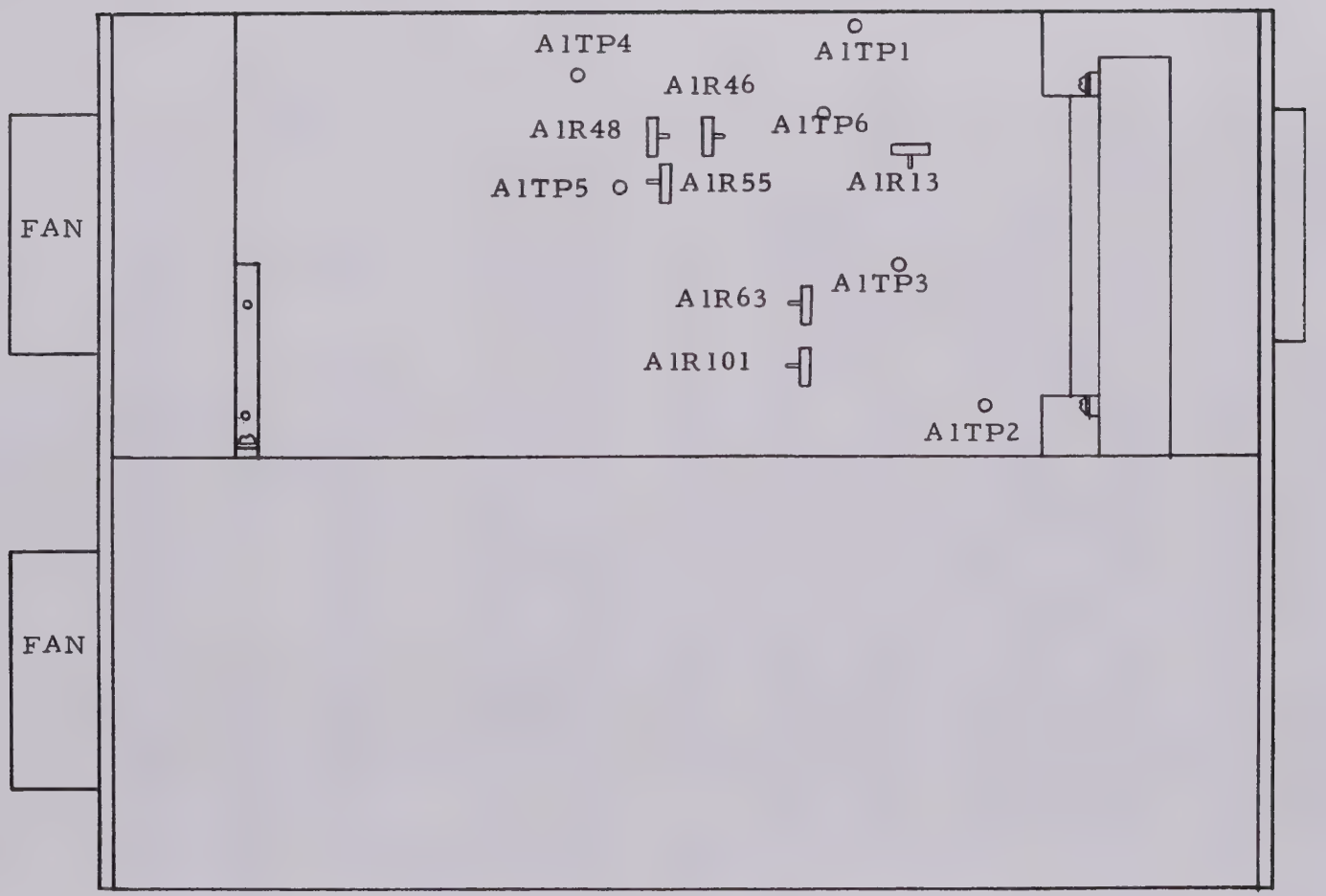


FIGURE 4-2 INTERNAL ADJUSTMENT FOR

MODEL 2501T POWER SOURCE

4.4.5 Open switch S2 so as to remove the full power load and then re-adjust the three phase line voltage to its nominal value (208 volts L-L) with the variac. Check that both the +66 volt and -66 volt DC supplies vary less than 0.25 volt DC from full-load operation to no-load operation.

4.5 OVERLOAD ADJUSTMENTS

4.5.1 Connect the Model 2501T Power Source as shown in Figure 4-3. Select the 120 volt range and adjust the output voltage of the power source to 110 volts rms (91.6 percent of rated output voltage) at 400Hz. Close switch S2 (4.84 ohm load) and re-adjust the output voltage slightly, if required, in order to maintain a 110 volt output. The power source should deliver a clean sine wave output with less than 0.30 percent distortion. Vary the frequency from 45Hz to 2KHz and check that the distortion does not exceed 0.50 percent at 2KHz over the three phase AC input line voltage range of 187.2 volts to 228.8 volts (208 volts nominal input voltage). Adjust potentiometer A1R48 so that no clipping or excessive distortion occurs on the positive peak of the output waveform under worst case conditions outlined above. Adjust potentiometer A1R46 so that no clipping or excessive distortion occurs on the negative peak of the output waveform under worst case conditions outlined above. These two adjustments may interact somewhat, so care should be taken not to move one adjustment excessively without checking the effect on the other adjustment.

4.5.2 Set the output of the power source to 110 V rms at 400Hz. Connect a 50 percent overload on the output of the power source and check that there is significant clipping on both the positive and negative peaks of the output waveform. Adjust potentiometer A1R55 so that the EXCESSIVE LOAD lamp is lit to about one-third of normal brightness with the 50 percent overload and is out with a normal 100 percent load.

If the front panel circuit breaker is activated, reset the circuit breaker according to the procedure given in step 2.5.6.

4.5.3 This procedure may be performed for any of the other output voltage ranges, rather than the 0 to 120 volt range, if desired. In this case, the rear loaded printed circuit assembly should be rotated to provide the proper output voltage range. The load impedance and output voltage levels should be taken from those given in Table 4-1.

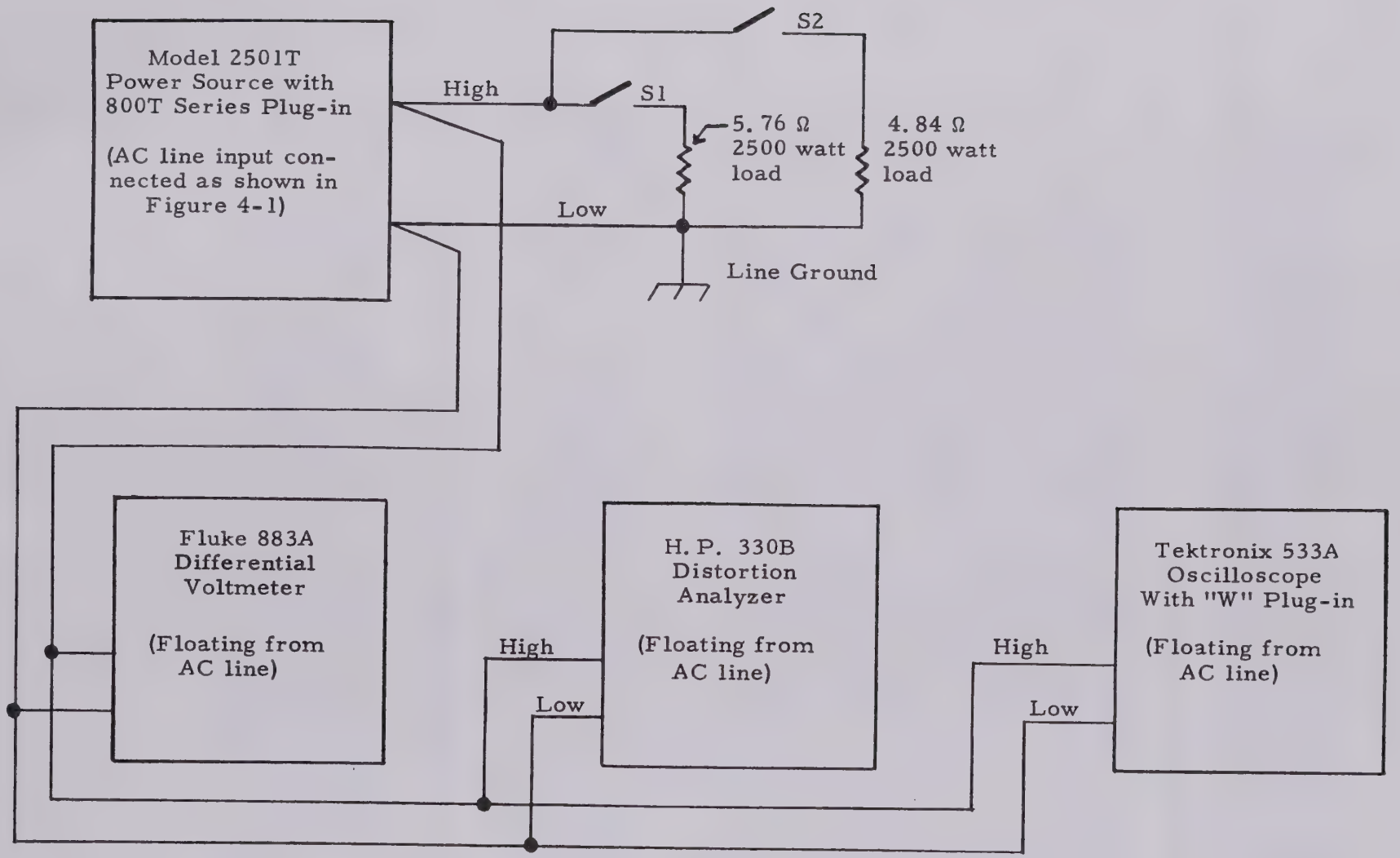


FIGURE 4-3. Test Circuit for Model 2501T Power Source.

4.6 HARMONIC DISTORTION

4.6.1 Connect the Model 2501T Power Source as shown in Figure 4-3. Select the 120 volt range with the rear loaded printed circuit assembly. Adjust the three phase input line voltage variac to provide a nominal input line voltage (208 volts L-L in this case). Set the oscillator output to 400Hz and adjust the output of the amplifier with the GAIN control to provide 120 volts rms (100% of rated output). Close switch S1 so that the 5.76 ohm load is across the output of the power source.

4.6.2 Vary the AC line voltage ±10 percent of nominal value with the three phase variac and check that no significant clipping is observed on the sine wave output with the oscilloscope. The harmonic distortion must be less than 0.3 percent over the full line voltage range.

4.6.3 Set the oscillator output to 45Hz and adjust the output of the power source to 120 volts rms with the GAIN control. Repeat step 4.6.2. The harmonic distortion must be less than 0.50 percent over the full line voltage range.

4.6.4 Set the oscillator output to 600Hz and adjust the output of the power source to 120 volts rms with the GAIN control. Repeat step 4.6.2. The harmonic distortion must be less than 0.30 percent over the full line voltage range.

4.6.5 Set the oscillator output to 2KHz and adjust the output of the power source to 120 volts rms with the GAIN control. Repeat step 4.6.2. The harmonic distortion must be less than 0.50 percent over the full line voltage range.

4.6.6 Repeat steps 4.6.1 through 4.6.5, except set the output of the power source to 110 volts rms (91.6 percent of rated output) and close switch S2 instead of S1. The harmonic distortion must be less than 0.30 percent from 200Hz to 600Hz, and less than 0.5 percent from 45Hz to 2KHz.

4.6.7 This procedure may be performed for any of the other output voltage ranges, rather than the 0 to 120 volt range, if desired. In this case, the rear loaded printed circuit assembly should be rotated to provide the proper output voltage range. The load impedance and output voltage levels should be taken from those given in Table 4-1.

4.7 AC LINE INPUT CURRENT

4.7.1 Connect the Model 2501T Power Source as shown in Figure 4-3. Select the 120 volt AC range according to the procedure given in Section 2.4 of this instruction manual.

4.7.2 Adjust the GAIN control on the power source to provide an output of 110 volts rms at 400Hz with switch S2 closed so as to apply full load to the output of the power source. With the three phase AC input line voltage adjusted to its maximum value (228.8 volts AC on 208 volt range), the average AC input line rms current should be less than 19 amperes and all three readings should be within 20 percent of the average line current when operating from the 60Hz AC line. The average AC input line rms current should be less than 20 amperes when operating from the 50Hz AC line.

4.7.3 Repeat step 4.7.2, except open switch S2 so that there is no load on the output of the power source. The average AC input rms line current should be less than 2 amperes and all three readings should be within 50 percent of the average line current when operating from the 60Hz AC line. The average AC input rms line current should be less than 4.5 amperes and all three readings should be within 50 percent of the average line current when operating from the 50Hz AC line.

4.7.4 This procedure may be performed for any of the other output voltage ranges, rather than the 0 to 120 volt range, if desired. In this case, the rear loaded printed circuit assembly should be rotated to provide the proper output voltage range. The load impedance and output voltage level should be taken from those given in Table 4-1.

4.8 LINE REGULATION

4.8.1 Connect the Model 2501T Power Source as shown in Figure 4-3. Select the 120 volt range according to the procedure given in Section 2.4 of this instruction manual. Adjust the variac to provide a 208 volt three phase AC line input. Set the oscillator frequency to 400Hz and adjust the GAIN control to provide a 120 volt rms output (100 percent of rated output voltage) with switch S1 closed so that a 5.76 ohm load is across the output of the power source.

4.8.2 Vary the AC input L-L voltage from 187.2 volts to 228.8 volts AC and measure the change in output voltage of the power source. This change should be less than 0.24 volts rms.

4.8.3 Set the oscillator frequency to 2KHz and adjust the amplitude control to provide a 120 volt L-N output and repeat 4.8.2. The change in output voltage should be less than 0.24 volts rms.

4.8.4 This procedure may be performed for any of the other output voltage ranges, rather than the 0 to 120 volt range, if desired. In this case, the rear loaded printed circuit assembly should be rotated to provide the proper output voltage range. The load impedance and output voltage level should be taken from those given in Table 4-1.

4.9 LOAD REGULATION ADJUSTMENT

The load regulation adjustment is accessible from the front panel of the power source and is usually adjusted for zero regulation at 400Hz. This adjustment is somewhat sensitive to the output voltage range and should be readjusted whenever the output voltage range is changed.

4.9.1 Connect the Model 2501T Power Source as shown in Figure 4-3. Check that the load is connected to the large AC output terminals TB10 at the rear of the power source. The output voltage may be monitored either at the rear or the front of the power source. If it is monitored at the rear of the power source, care should be taken to use four-wire sensing. Adjust the output voltage of the Model 2501T Power Source to 110 rms output (91.6 percent of rated output voltage) at 400Hz.

4.9.2 Place the differential voltmeter on the 1000 volt AC range and connect it across the front panel output terminals of the power source. Adjust R9 (accessible from the front panel of the power source and labeled REG) so that the output voltage variation is less than 20 millivolts as the 4.84 ohm load is added and removed. Maintain the line voltage at nominal value during this test.

4.9.3 Set the frequency of the oscillator to 2KHz. Adjust the output amplitude of the power source to 110 volts rms with no load on the output of the power source. The output of the power source should change less than ±1.10 volts rms when loaded with the 4.84 ohm resistor. Maintain the line voltage at nominal value during this test. Capacitors A1C3 and A1C4, in the secondary circuit of A1T1, have been set at the factory for optimum load regulation at 2 KHz and may be changed, if required.

4.9.4 Set the frequency of the oscillator to 45Hz and repeat 4.9.3. The output of the power source should change less than ±1.10 volt rms.

4.9.5 This procedure (steps 4.9.1 through 4.9.4) may be performed for any of the other output voltage ranges, rather than the 0 to 120 volt range, if desired. In this case, the rear loaded printed circuit assembly should be rotated to provide the proper output voltage range. The load impedance and output voltage levels should be taken from those given in Table 4-1. Care should be taken to use non-inductive load resistors, especially on the 30 volt and 60 volt output voltages ranges where load impedances are very low and a few microhenries of inductance will significantly influence the power factor at 2KHz. The load regulation must remain within a ±1 percent band from 45Hz to 1KHz and within a ±2 percent band from 45Hz to 2KHz on the 60 volt and 240 volt output ranges. The load regulation must remain within a ±1 percent band from 45Hz to 1.0KHz and within a ±3 percent band from 45Hz to 2KHz on the 30 volt range.

NOTE

Care should be taken to insure that the output amplitude of the oscillator remains stable and independent of load conditions during this test.

4.10 AMPLITUDE STABILITY

4.10.1 Connect the Model 2501T Power Source as shown in Figure 4-3. Adjust the three phase AC input line voltage to 208 volts L-L. Adjust the output of the power source to provide a 115 volts rms output (95.8 percent of rated output voltage) at 400Hz. Connect a 5.29 ohm (2500 VA) load to the output terminals at the rear of the power source and check that the REG control has been set to provide a zero output impedance.

4.10.2 Connect an AC expanded scale (about 115 volts rms) strip chart recorder across the output terminals of the power source and record the drift during a 24 hour period. This drift should be less than ±0.29 volts rms. Disregard the drift during the first hour, as this represents initial warm-up drift. Care should be taken to insure that the ambient temperature is held constant at ±3 degrees centigrade for this test.

4.10.3 This procedure may be performed for any of the other output voltage ranges, rather than the 0 to 120 volt range, if desired. In this case, the rear loaded printed circuit assembly should be rotated to provide the proper output voltage range. The load impedance and output voltage level should be taken from those given in Table 4-1 consistent with the dynamic range of the specific expanded scale strip chart recorder employed for the test.

4.11 FREQUENCY RESPONSE

4.11.1 Connect the Model 2501T Power Source as shown in Figure 4-3. Adjust the three phase input AC line voltage to 208 volts L-L. Adjust the output of the power source to provide 120 volts rms (100 percent of rated output voltage) at 400Hz.

4.11.2 Vary the output frequency of the oscillator from 45Hz to 2KHz and monitor the output voltage of the power source with a differential voltmeter under no-load conditions. The output of the power source should vary less than ±7.1 volts rms from 45Hz to 2KHz.

4.11.3 Close switch S1 and repeat 4.11.1 and 4.11.2. The output of the power source should vary less than ±7.1 volts rms from 45Hz to 2KHz.

4.11.4 This procedure may be performed for any of the other output voltage ranges, other than the 0 to 120 volt range, if desired. In this case, the rear loaded printed circuit assembly should be rotated to provide the proper output voltage range. The load impedance and output voltage level should be taken from those given in Table 4-1. The output must vary less than ±0.5 dB from 45Hz to 2KHz.

4.12 AC NOISE LEVEL

4.12.1 Connect the Model 2501T Power Source as shown in Figure 4-3. Adjust the three phase input line voltage to 208 volts L-L. Adjust the output of the power source to provide 110 volts rms (91.6 percent of rated output voltage) at 60Hz.

4.12.2 Close switch S2 and monitor the output of the power source with the Tektronix 533A Oscilloscope with a "W" plug-in. Using the offset feature of the "W" plug-in, observe the positive peak of the output voltage at a vertical sensitivity of 0.5 volt per centimeter and sweep rate of 0.2 millisecond per centimeter using the oscilloscope in the LINE SYNC mode of operation, rock the oscillator frequency slightly so that the peak value of the output wave form is displayed on the oscilloscope. The peak noise and ripple riding on the sine wave output should not exceed 0.492 volt (50 dB below full output). The noise and ripple output may be slightly greater if the power source is tested with the AC input line voltage somewhat above nominal value.

4.12.3 Steps 4.12.1 and 4.12.2 may be performed on any of the other output voltage ranges, if desired. In this case, the rear loaded printed circuit assembly should be rotated to provide the proper output voltage range. The load impedance and output voltage level should be taken from those given in Table 4-1. The chart on the following page gives the acceptable noise level output on each voltage range.

Rated Output Voltage	30 VAC	60 VAC	120 VAC	240 VAC
Peak Noise Level with 2500 VA Load (See 4.12.2)	0.123 V Peak	0.246 V Peak	0.492 V Peak	0.984 V Peak

4.13 0.7 LAGGING POWER FACTOR

4.13.1 Connect the Model 2501T Power Source as shown in Figure 4-3. Select the load circuit to correspond with the required output voltage range. Figure 4-4 illustrates the load circuit and gives load parameter values for 2500 VA 0.7 power factor at 400Hz with 91.6 percent of rated output voltage from the power source. This represents the worst case inductive load for maximum power dissipation inside the power source.

4.13.2 Set the oscillator frequency to 400Hz and adjust the GAIN control for 91.6 percent of rated output voltage. Check that the power source produces a stable output with no high-frequency oscillation or excessive distortion. Refer to Section 4.6 of this instruction manual for the procedure to measure harmonic distortion. This distortion must be less than 0.30 percent at 400Hz. The overload adjustments, A1R46 and A1R48, may have to be rotated counter-clockwise (when viewed from the front of the 2501T) slightly with a 0.7 power factor load to meet the 0.30 percent distortion specification.

4.13.3 The REG control usually does not require significant readjustment in order to provide a zero regulation with a 0.7 power factor load at 400Hz. If the unit is to be operated at a 0.7 power factor in the high frequency region, i.e. at 2KHz, then it may be necessary to readjust the REG control. In this case, rotate the front panel REG control until zero regulation is obtained at the specific frequency and load condition.

4.13.4 The three phase AC line input current is 19 amperes per leg maximum with an 0.7 power factor load at 91.6 percent of rated output voltage and an input L-L voltage of 228.8 volts at 60Hz (on 208 volt L-L range).

4.13.5 The above test may be repeated at frequencies other than 400Hz, provided that the inductance of the series inductor is changed inversely proportional to the absolute value of the test frequency. For example, at 1KHz, the inductance value must be divided by 2.5. The series resistance value remains unchanged.

4.14 0.7 LEADING POWER FACTOR

4.14.1 Connect the Model 2501T Power Source as shown in Figure 4-3. Select the load circuit to correspond with the required output voltage range. Figure 4-5 illustrates the load circuit and gives load parameter values for 2500 VA 0.7 power factor operation at 400Hz with 91.6 percent of rated output voltage from the power source. This represents the worst case capacitive load for maximum power dissipation inside the power source.

4.14.2 Set the oscillator frequency to 400Hz and adjust the GAIN control for 91.6 percent of rated output voltage. Check that the power source produces a stable output with no high frequency oscillation or excessive distortion. Refer to Section 4.6 for the procedure to measure harmonic distortion. This distortion must be less than 0.30 percent at 400Hz. The overload adjustments, A1R46 and A1R48, may have to be rotated counterclockwise (when viewed from the front of the 2501T) slightly with a 0.7 power factor load to meet the 0.30 percent distortion specification.

4.14.3 The REG control usually does not require significant readjustment in order to provide a zero regulation with a 0.7 power factor load at 400Hz. If the unit is to be operated at a 0.7 power factor in the high frequency region, i.e. at 2KHz, then it may be necessary to readjust the REG control. In this case, rotate the front panel REG control until zero regulation is obtained at the specific frequency and load condition.

4.14.4 The three phase AC line rms input current is 19 amperes per leg maximum with a 0.7 power factor load at 91.6 percent of rated output voltage and an input L-L voltage of 228.8 volts at 60Hz (on 208 volt L-L range).

4.14.5 The above test may be repeated at frequencies other than 400Hz, provided that the capacitance of the series capacitor is changed inversely proportional to the absolute value of the test frequency. For example, at 1KHz, the capacitance value must be divided by 2.5. The series resistance value remains unchanged.

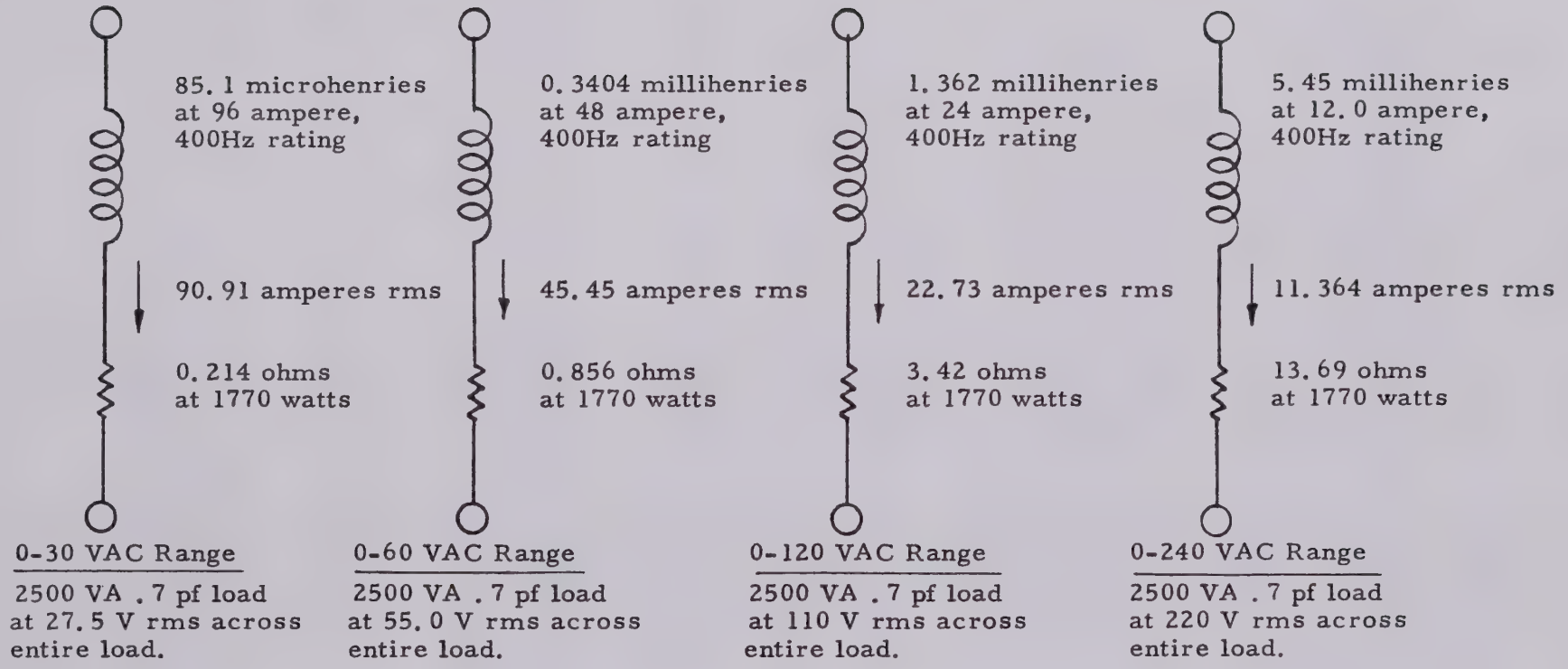


FIGURE 4-4. Load Circuit for 0.7 Lagging Power Factor at 400Hz.

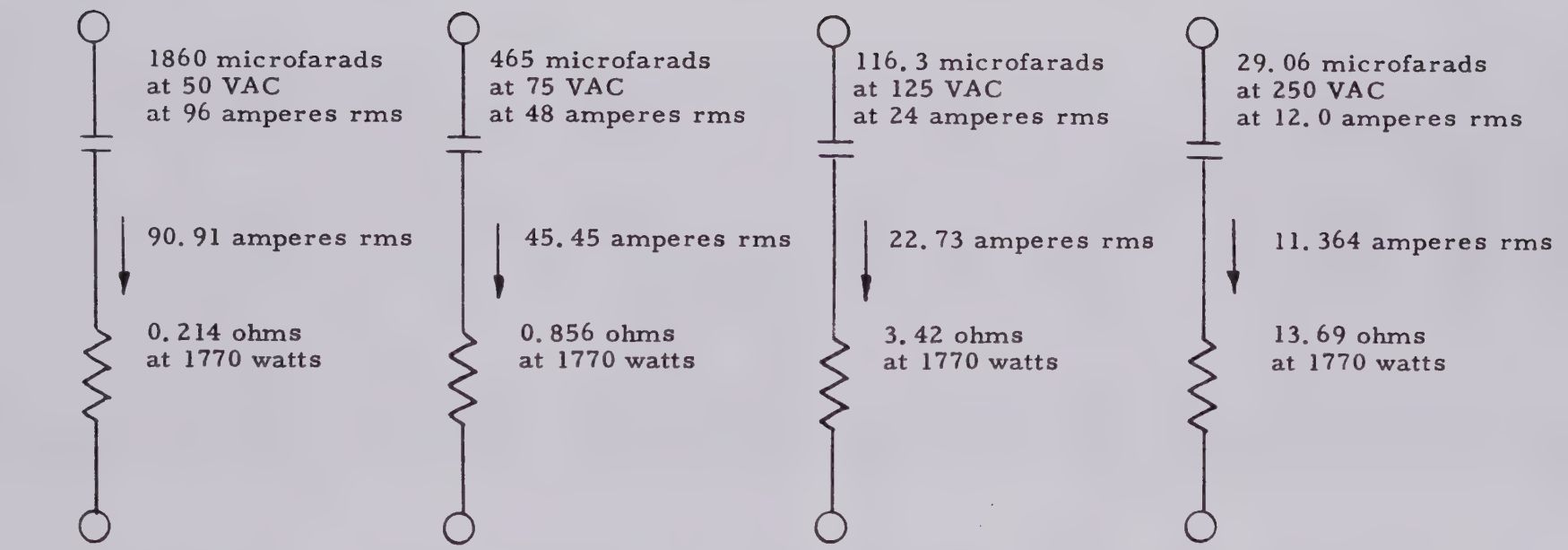


FIGURE 4-5. Load Circuit for 0.7 Leading Power Factor at 400Hz.

WARNING

Voltages up to 480 VAC are available in certain sections of this power source. This equipment generates potentially lethal voltages.

DEATH

on contact may result if personnel fail to observe safety precautions. Do not touch electronic circuits when power is applied. Avoid contact with pin C and pin D of the plug-in oscillator, the primary power circuits, and the output circuits of the power source.

MAINTENANCE AND TROUBLESHOOTING

5.1 GENERAL

The California Instruments Model 2501T Power Source is a solid state unit and should require a minimum of maintenance. However, it is forced air cooled and will accumulate some dust with time. The power transistor heatsinks should receive a forced air bath at intervals not to exceed six months.

CAUTION

Failure to keep the heatsinks clean will reduce their thermal transfer efficiency somewhat and could cause failure of the power source.

5.2 TROUBLESHOOTING

5.2.1 If a problem appears in the power source, it must be isolated to a specific section of the unit. Before servicing the amplifier, check that the AC power input to the unit is of the proper amplitude and frequency. Check that the signal input to the power amplifier is also of the proper amplitude (approximately 5 volts rms) and frequency (45Hz to 2KHz). Check that the output load on the power amplifier is not excessive or that the load starting transients are not excessive. Check that the output of the oscillator is coupled to the input of the power amplifier through the 12 pin connector on the rear of the power amplifier.

5.2.2 If the circuit breaker is activated as soon as power is applied to the Model 2501T, wait one minute and again try to reset the circuit breaker. If the circuit breaker will not properly reset, check that one or more of the power transistors are not shorted. Also check for a shorted SCR, a shorted rectifier diode or a shorted filter capacitor with an ohmmeter.

5.2.3 If the problem is in the regulated power supplies, disconnect the base drive to both A3Q1 and A4Q1 at the in-line splices. This will prevent possible damage to the output stage while troubleshooting the regulated power supplies. The ±66 volt supplies should each exhibit less than 2 volts of overshoot when power is applied to the unit under high input line voltage conditions.

While testing the ±66 volt regulated power supplies, without the output stage base drive connected, use a 5 ohm 50 watt resistor to remove charge from the main filter capacitors after the unit has been switched "OFF". Information concerning power supply ripple and voltage tolerance is given in Section 3.2.7 and 3.2.8 of this instruction manual.

5.2.4 Check that the quasi-complementary symmetry output amplifier is operating properly and is not drawing excessive current under no load conditions. Section 3.2.2 of this instruction manual describes the operation of this output amplifier.

5.2.5 Check that the overload circuitry is operating properly. The overload circuit may be disabled by removing A1CR6 and A1CR7.

5.2.6 If the problem has been resolved to be in the oscillator, consult the applicable oscillator instruction manual.

CIRCUIT DIAGRAMS

6.1 GENERAL

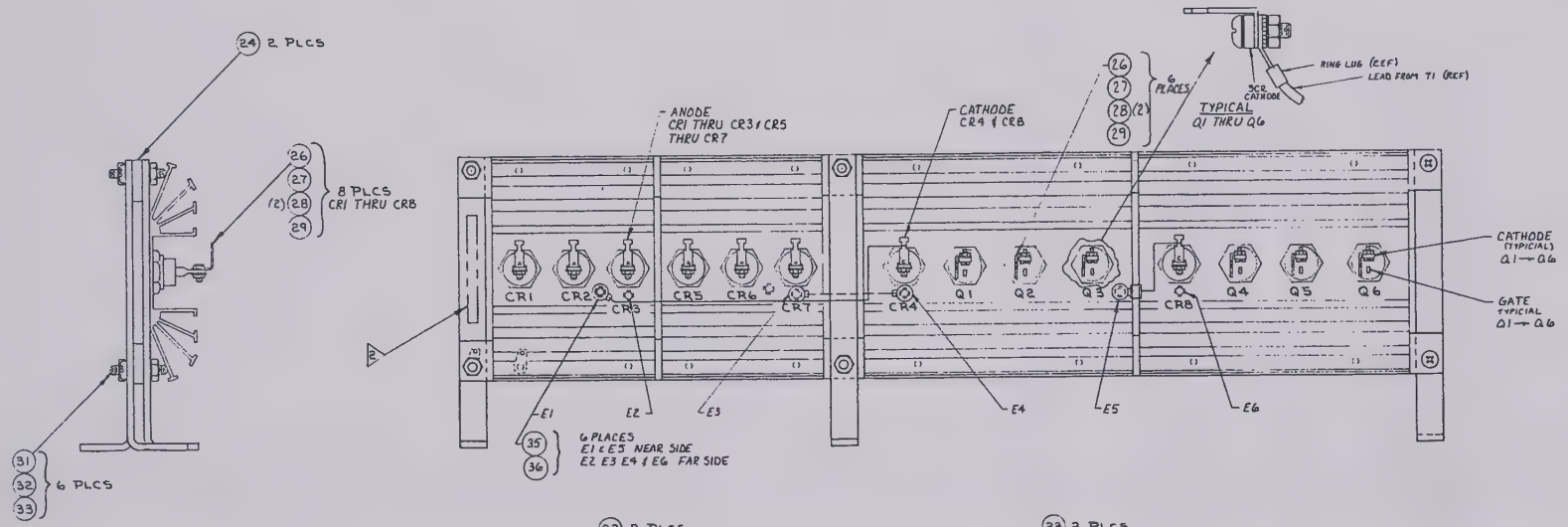
This section contains schematics and mechanical diagrams necessary for operation and maintenance of the Model 2501T AC Power Source. The schematic diagrams illustrate the circuit while the mechanical assemblies indicate the part placement.

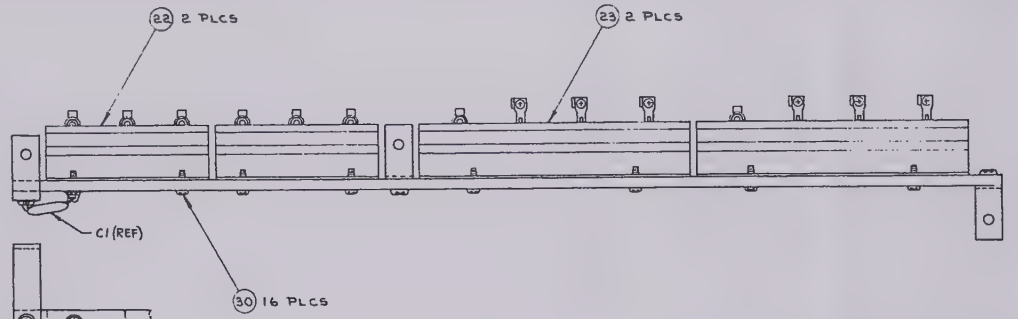
6.2 REFERENCE DESIGNATIONS

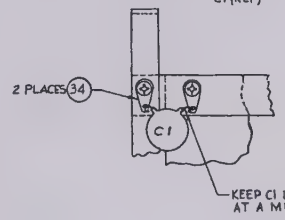
Partial reference designators are shown on schematic and mechanical drawings. Prefix these reference designators with assembly and/or sub-assembly designation for the complete reference designator. For example:

Assembly/Sub-Assembly	Component	Component Designation
A1	C14	A1C14
None	T1	T1
A2	Q1	A2Q1

REVISIONS						
REV	AUTH	DESCRIPTION	ZONE	EFF ON	DATE	APRD
A	DC	GENERAL CLEAN UP SB			7/7/72	







-1 PWR RECTIFIER ASSY

W.T.T.

WIRE NO	FROM	TO	AWG	COLOR	REMARKS
1	CR4-CATH	E1	14	WHT	R4161(1) AT E1
2	E3	E4	10	WHT	R4170 (2) FAR SIDE
3	CR8-CATH	E5	14	ORN	R4161(1)
4	CR1-ANODE	Q1-CATH	14	BUS	TFL. SLV.
5	CR2-ANODE	Q2-CATH	14	BUS	TFL. SLV.
6	CR3-ANODE	Q3-CATH	14	BUS	TFL. SLV.
7	CR5-ANODE	Q4-CATH	14	BUS	TFL. SLV.
8	CR6-ANODE	Q5-CATH	14	BUS	TFL. SLV.
9	CR7-ANODE	Q6-CATH	14	BUS	TFL. SLV.

2. FOR SCHEMATIC SEE DRAWING NO. E4250-070.

▷ INK STAMP ASSEMBLY NO. & REF. DES "A2" APPROX AS SHOWN (NEAR SIDE).

NOTES: (UNLESS OTHERWISE SPECIFIED)

ITEM NO.	PART NUMBER	PART NAME	MATERIAL — SPECIFICATION	CODE IDENT	FINISH	REF DES.	ZONE
REQD PER ASSY	PL4250-401-1	PARTS LIST	SEE SHEET 3				

DIM IN INCHES TOLERANCES XXX = .010 XX = .02 X° = 30° BREAK ALL SHARP CORNERS & EDGES MACH SURFACES

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DWG SIZE D

TITLE 3 PHASE POWER RECTIFIER ASSEMBLY A2

MODEL 2501 T

DASH NO.	QTY REQD	NEXT ASSEMBLY	EFF ON	AUTH
-1	1	E4250-400-1		

RELEASE — CHECKER — DESIGN — DRAFTSMAN J. LARA 8/24/72 — PURCHASING — PROJ ENGR — CHF ENGR

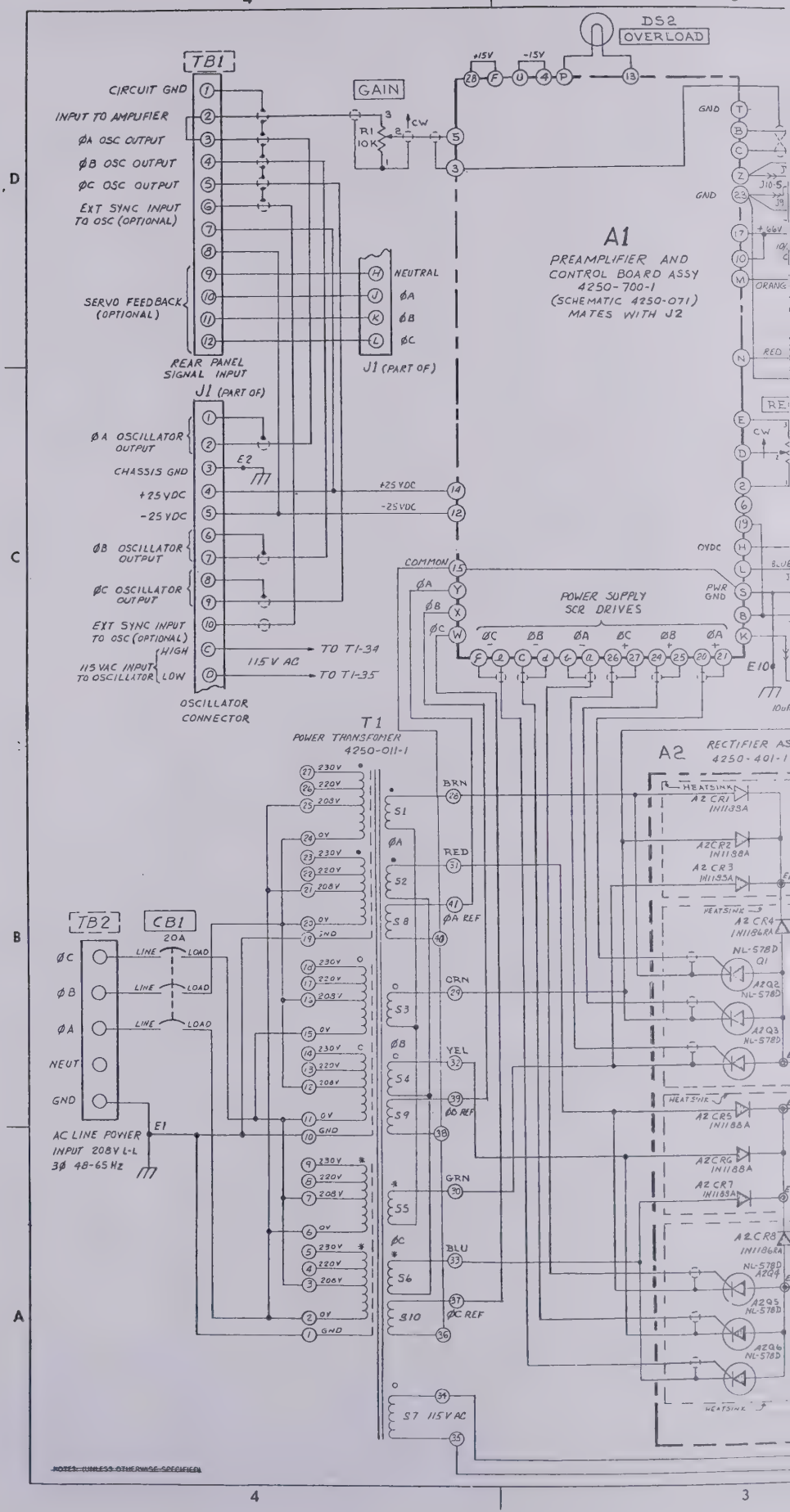
CALIFORNIA INSTRUMENTS CORP. SAN DIEGO, CALIFORNIA

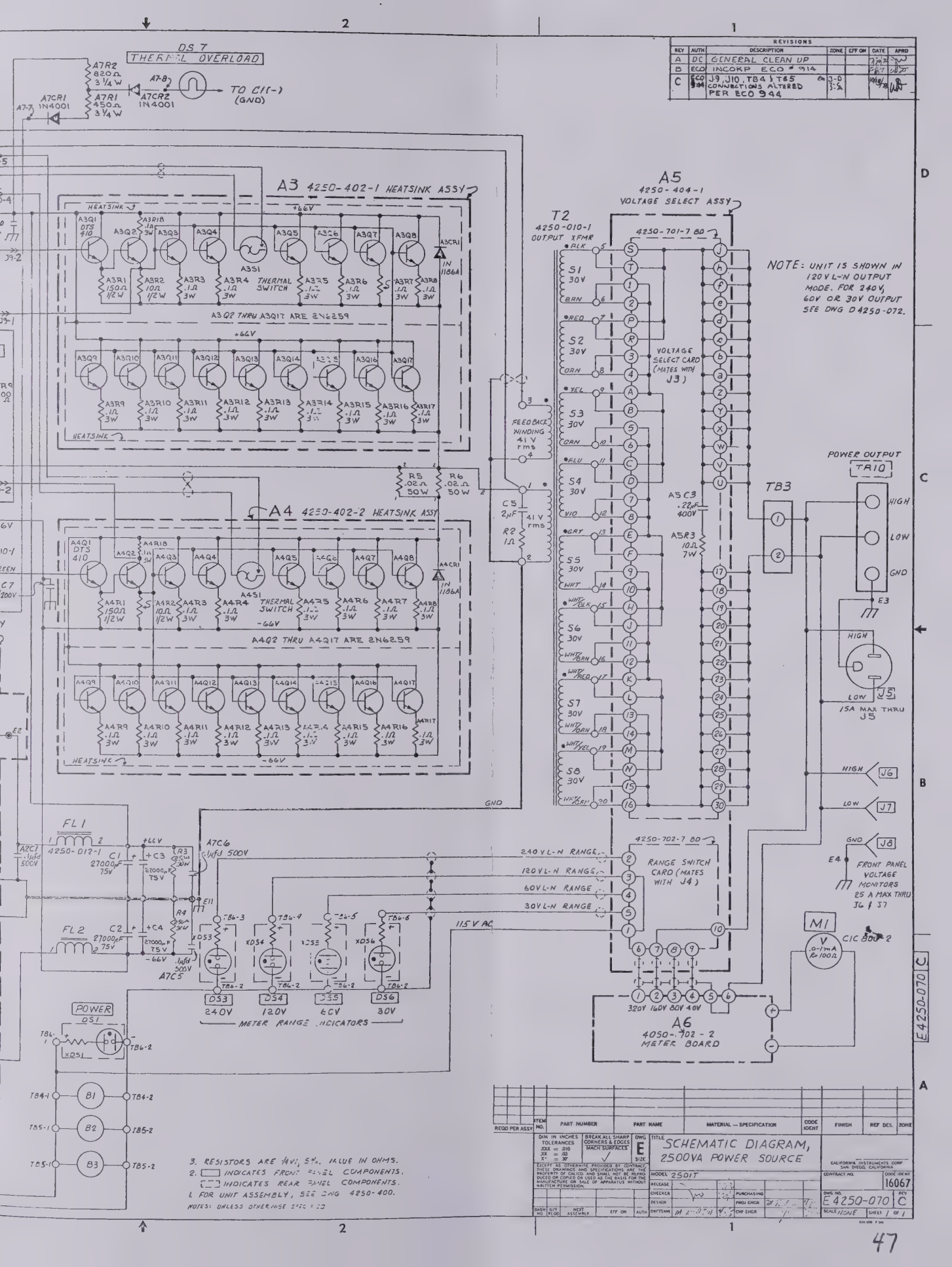
CONTRACT NO. — CODE IDENT 16067

DWG NO. D4250-401 REV A

SCALE 1:1 SHEET 2 OF 3

D4250-401 A


DS2
OVERLOAD
TB1
CIRCUIT GND
INPUT TO AMPLIFIER
ØA OSC OUTPUT
ØB OSC OUTPUT
ØC OSC OUTPUT
EXT SYNC INPUT TO OSC (OPTIONAL)
SERVO FEEDBACK (OPTIONAL)
REAR PANEL SIGNAL INPUT
GAIN
R1 10K
CW
+15V
-15V
NEUTRAL
ØA
ØB
ØC
J1 (PART OF)
A1
PREAMPLIFIER AND CONTROL BOARD ASSY 4250-700-1
(SCHEMATIC 4250-071)
MATES WITH J2
ØA OSCILLATOR OUTPUT
CHASSIS GND
E2
+25 VDC
-25 VDC
ØB OSCILLATOR OUTPUT
ØC OSCILLATOR OUTPUT
EXT SYNC INPUT TO OSC (OPTIONAL)
115 VAC INPUT TO OSCILLATOR
HIGH
LOW
115 V AC
TO T1-34
TO T1-35
OSCILLATOR CONNECTOR
COMMON
POWER SUPPLY SCR DRIVES
PWR GND
OVDC
E10
T1
POWER TRANSFOMER 4250-011-1
230V
220V
208V
0V
GND
S1
S2
S8
S3
S4
S9
S5
S6
S10
S7 115V AC
BRN
RED
ØA REF
GRN
YEL
ØB REF
BLU
ØC REF
A2
RECTIFIER AS 4250-401-1
HEATSINK
A2 CR1 IN1183A
A2CR2 IN1188A
A2 CR3 IN1183A
A2 CR4 IN1186RA
NL-578D
Q1
A2Q2 NL-578D
A2Q3 NL-578D
A2 CR5 IN1188A
A2CR6 IN1188A
A2 CR7 IN1183A
A2CR8 IN1186RA
A2Q4
A2Q5 NL-578D
A2Q6 NL-578D
TB2
CB1
20A
ØC
ØB
ØA
NEUT
GND
LINE
LOAD
AC LINE POWER INPUT 208V L-L 3Ø 48-65 Hz
E1
NOTES: (UNLESS OTHERWISE SPECIFIED)



REVISIONS					
REV	AUTH	DESCRIPTION	ZONE	ECN OR	DATE / APRD
A	DC	GENERAL CLEAN UP			7/9/72
B	ECO	INCORP ECO # 914			5/8/7
C	ECO 944	J9, J10, TB4 & TB5 CONNECTIONS ALTERED PER ECO 944	J-D J-2		10/6/7

ITEM NO.	PART NUMBER	PART NAME	MATERIAL — SPECIFICATION	CODE IDENT	FINISH	REF DES.	ZONE
REQD PER ASSY							

DIM. IN INCHES TOLERANCES: XXX = .010, XX = .03, X° = 30' | BREAK ALL SHARP CORNERS & EDGES MACH SURFACES ✓ | DWG SIZE E

TITLE: SCHEMATIC DIAGRAM, 2500VA POWER SOURCE

CALIFORNIA INSTRUMENTS CORP SAN DIEGO, CALIFORNIA

MODEL 2500T | CONTRACT NO. | CODE IDENT NO. 16067

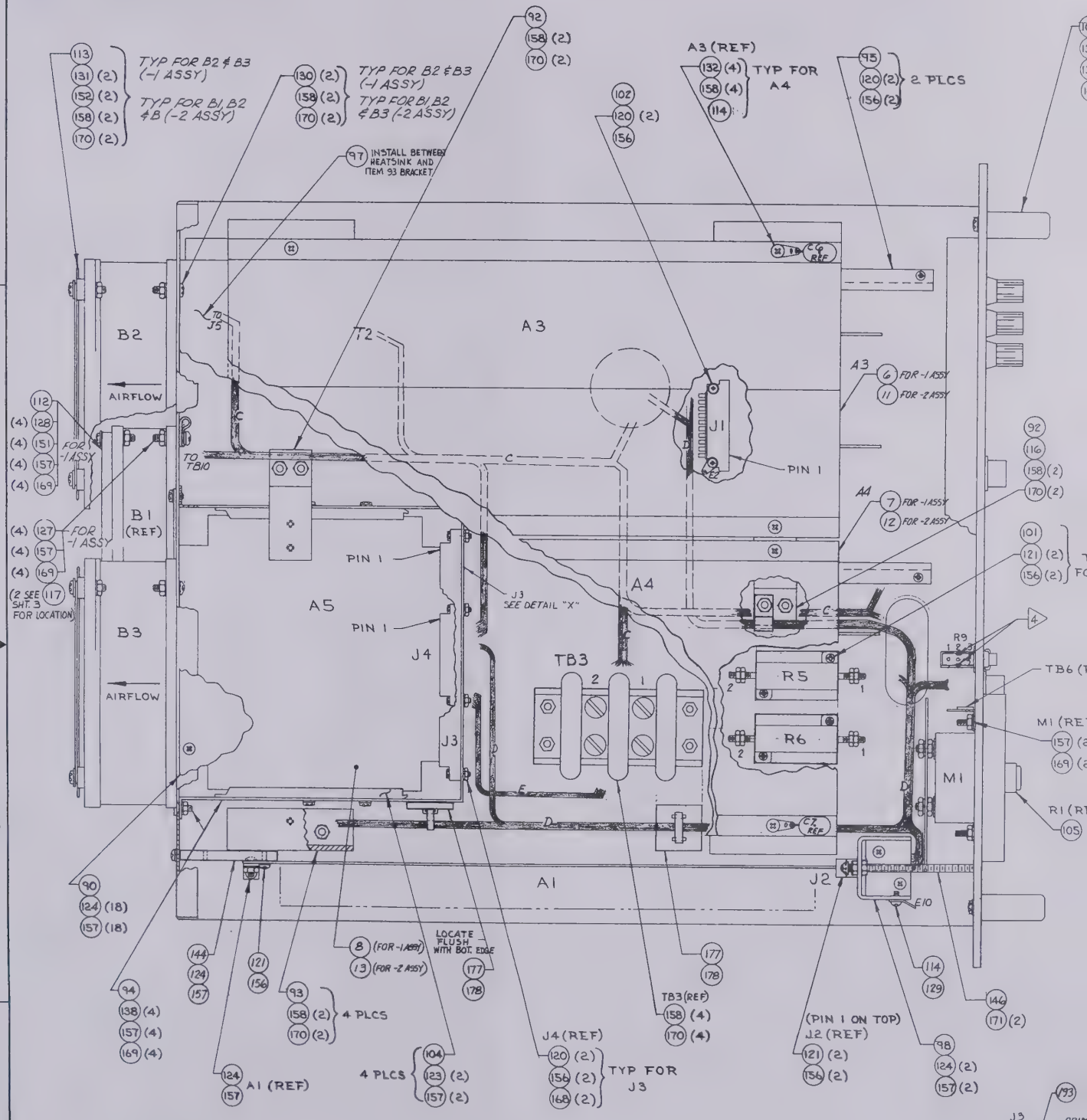
RELEASE | CHECKER | DESIGN | DRFTSMN | PURCHASING | PROJ ENGR | CHF ENGR

DWG NO. E4250-070 | REV C | SCALE NONE | SHEET 1 OF 1

DASH NO. | QTY REQD | NEXT ASSEMBLY | EFF ON | AUTH

THIS DRAWING AND SPECIFICATION, EITHER OR BOTH, IS THE PROPERTY OF CALIFORNIA INSTRUMENTS CORP AND SHALL NOT BE REPRODUCED OR COPIED OR USED AS THE BASIS FOR THE MANUFACTURE OR SALE OF APPARATUS WITHOUT WRITTEN PERMISSION.

E4250-070 C



7. FOR SCHEMATIC SEE DWG. No. 4250-080 (FOR 3001T)

6 APPLY ITEM 196 FISH PAPER (USING 9M ADHESIVE) TO ITEM 91 BOTTOM COVER, LOCATE ABOVE T2 -TERMINAL AREA

5 APPLY ITEM 176 (RTV 108) BETWEEN C6 & SIDE INSULATOR (TYP FOR C7)

4 APPLY ITEM 176 (RTV 108) BETWEEN R9 & POT HOLDER

3. ROTATE B1, B2 & B3 SO WIRE TERMINALS ARE ADJACENT TO GROMMET FOR INTERNAL WIRING.

2. FOR WIRE TAB TABLE SEE DWG NO. 4250-050.

1 FOR SCHEMATIC SEE DWG NO. 4250-070. (FOR 2501T)

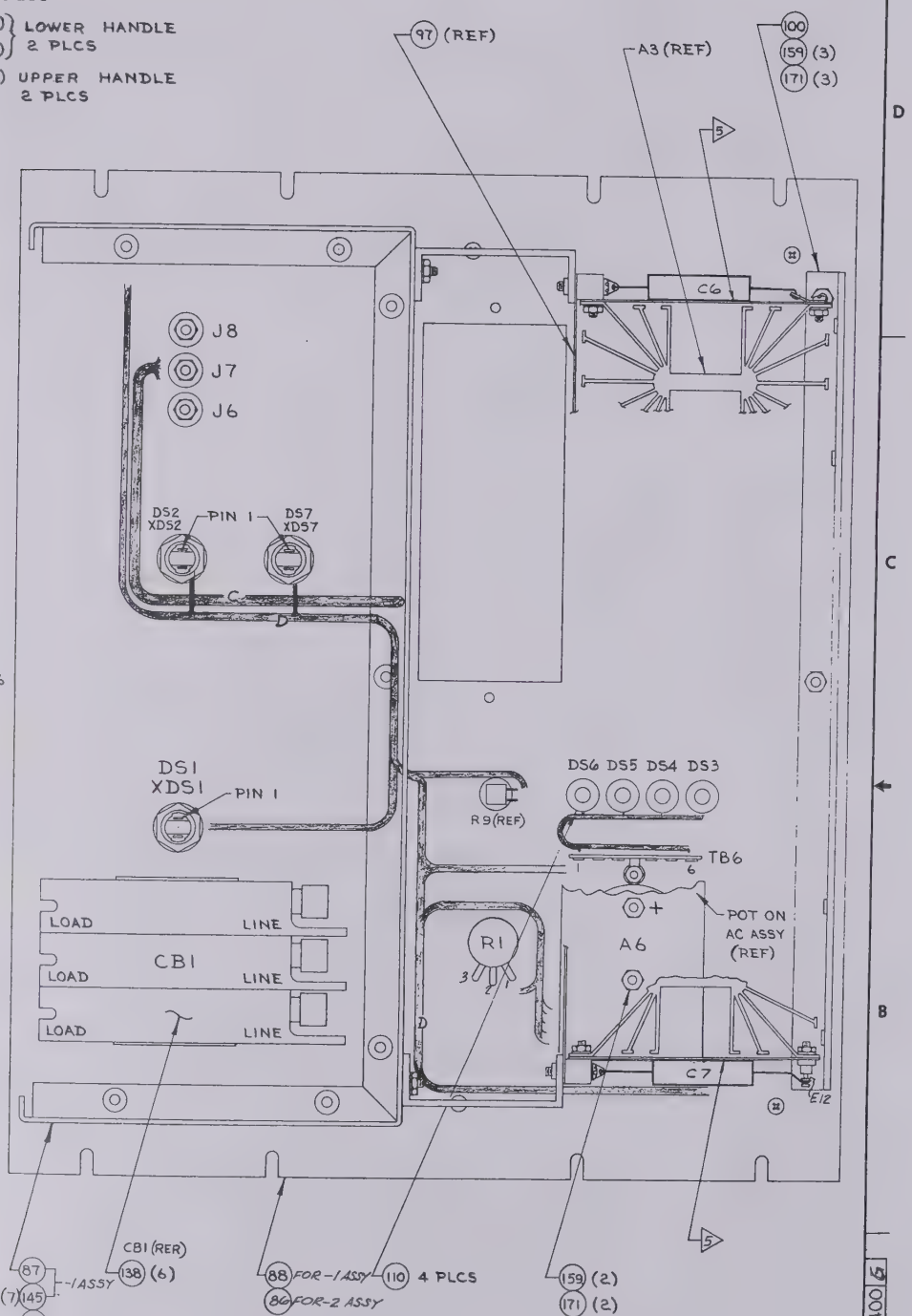
NOTES: (UNLESS OTHERWISE SPECIFIED)

TOP VIEW

-1 ASSY (FOR 2501T)
-2 ASSY (FOR 3001T)

REVISIONS						
REV	AUTH	DESCRIPTION	ZONE	EFF ON	DATE	APRD

3) 4 PLCS
D (2) } LOWER HANDLE
B (2) } 2 PLCS
1 (2) UPPER HANDLE
2 PLCS



FRONT PANEL
(VIEWED FROM INSIDE)

REQD PER ASSY	ITEM NO.	PART NUMBER	PART NAME	MATERIAL — SPECIFICATION	CODE IDENT	FINISH	REF DES.	ZONE
		PL4250-400	PARTS LIST	SHEET 4 THRU 9				

DIM IN INCHES TOLERANCES .XXX = ±.010 .XX = ±.03 X° = ±30' | BREAK ALL SHARP CORNERS & EDGES MACH SURFACES ✓ | DWG SIZE E

EXCEPT AS OTHERWISE PROVIDED BY CONTRACT, THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF CALIDS AND SHALL NOT BE REPRO. MANUFACTURE OR SALE OF APPARATUS WITHOUT WRITTEN PERMISSION.

TITLE: TOP ASSEMBLY
2500 VA PWR SOURCE

MODEL 2501T / 3001T

RELEASE			
CHECKER		PURCHASING	
DESIGN		PROJ ENGR	9/6/76
DRAFTSMAN	J. LARA	CHF ENGR	9/6/76

CALIFORNIA INSTRUMENTS CORP
SAN DIEGO, CALIFORNIA

CONTRACT NO. | CODE IDENT 16067

DWG NO. E4250-400 | REV G

SCALE 1:1 | SHEET 2 OF 8

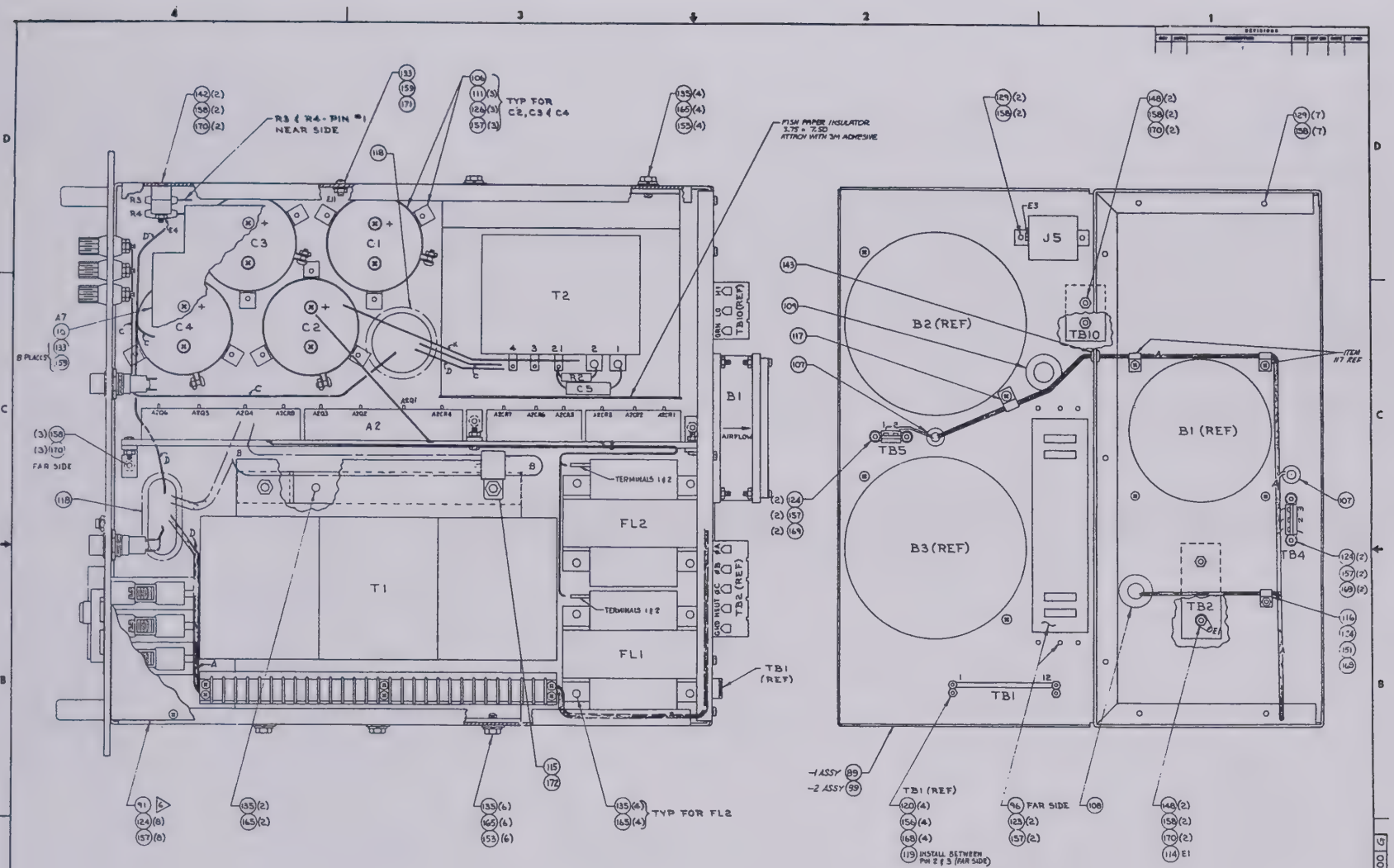
DASH NO.	QTY REQD	NEXT ASSEMBLY	EFF ON	AUTH

E4250-400 G

A

WIRE FROM T2 (REF)

SHRINK TUBE



ITEM NO.	PART NUMBER	PART NAME	MATERIAL — SPECIFICATION	CODE IDENT	FINISH	NOT USED	ZONE

NEXT ASSY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES .XXX = ±.010 .XX = ±.02 .X = ±.1 ANGLES ±1° BREAK ALL SHARP CORNERS & EDGES MAKE SURFACES

SIZE E

TITLE TOP ASSEMBLY 2500 VA PWR SOURCE

MODEL 2501T/3001T

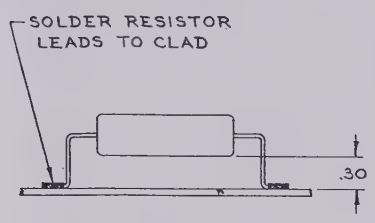
DRAWING NO. E4250-400

CODE IDENT NO. 16067

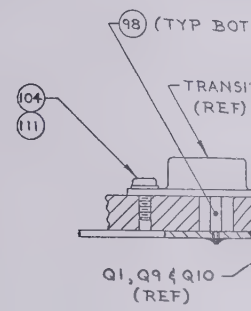
SCALE 1:1 SHEET 3 OF 8

REVISIONS

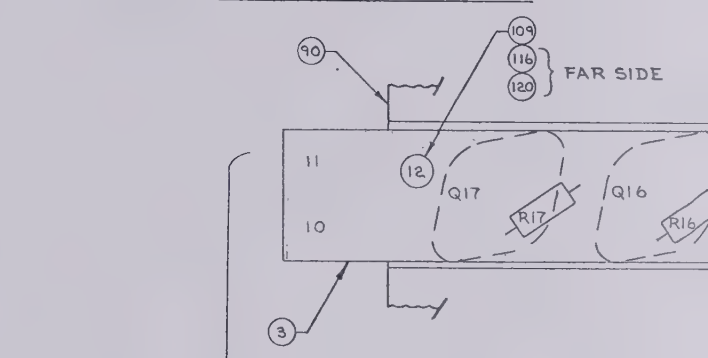
-4250-400 G

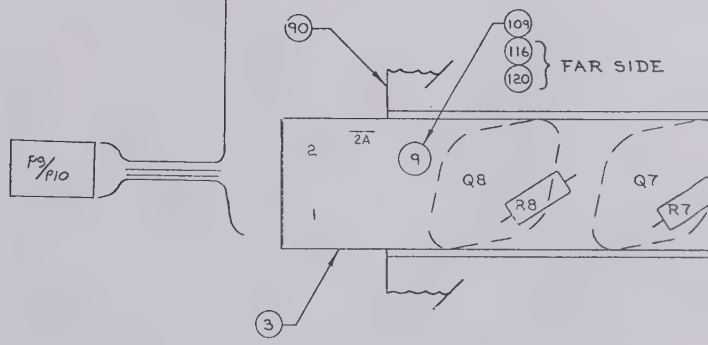


DETAIL A
TYP R1 THRU R18.

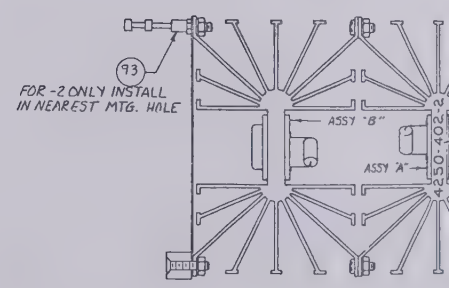


DETAIL B
TYP Q1 & Q3 THR





-2 ASSY A4
-66V

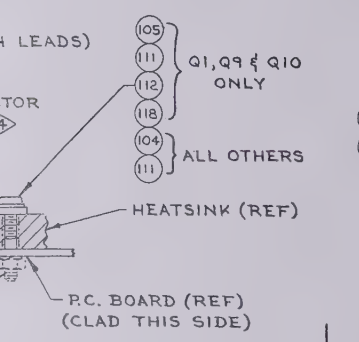


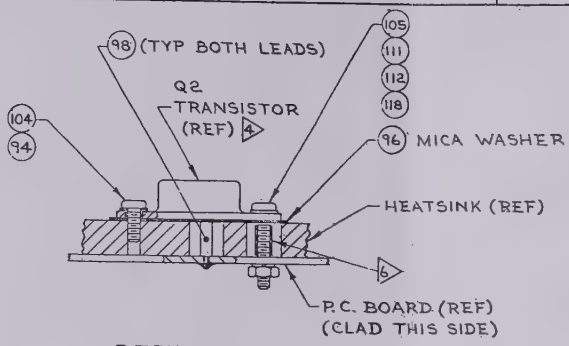
6> ITEM 105 TO BE INSULATED FROM HEATSINK, USING TEFLON SLEEVING OVER SCREW THDS. (FOR Q2
5> Q2 MUST BE INSULATED FROM HEATSINK PER DETAIL "C."
4> APPLY ITEM 95 BETWEEN TRANSISTORS AND HEATSINK AND BETWEEN 51 & HEATSINK.
3> INK STAMP ASSY PART NO. APPROX AS SHOWN.
2> IDENTIFY WIRES WITH ITEM 97.
1. FOR SCHEMATIC SEE DRAWING NO. E4250-070.

4 PLC

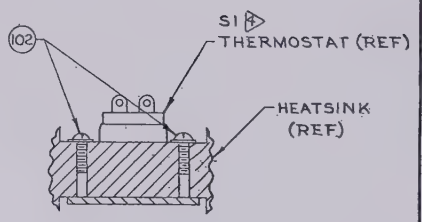
NOTES: (UNLESS OTHERWISE SPECIFIED)

REVISIONS					
REV	AUTH	DESCRIPTION	ZONE	EFF ON	DATE	APRD

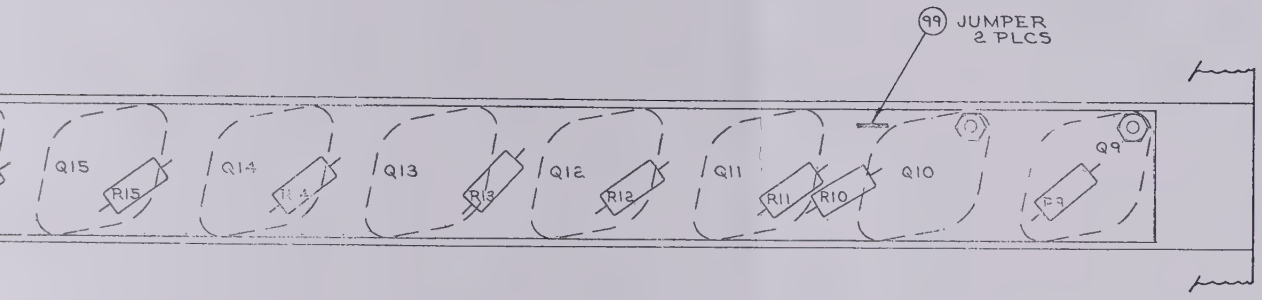




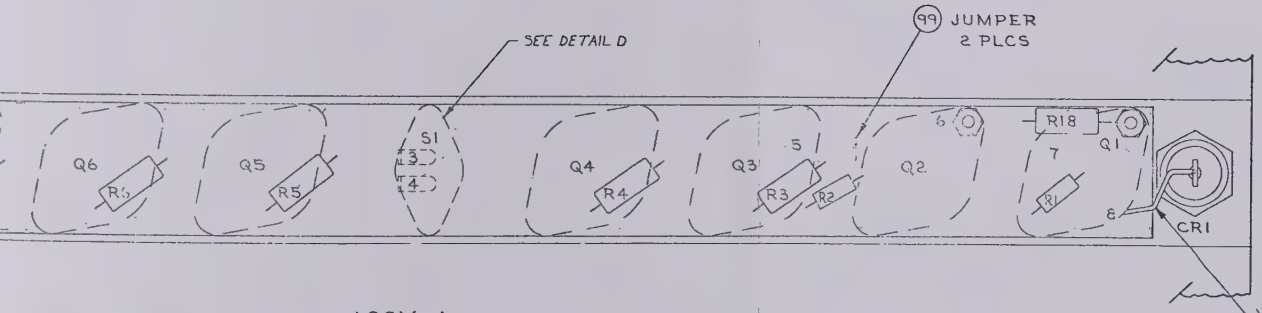
DETAIL C
Q2 FOR ASSY A ONLY



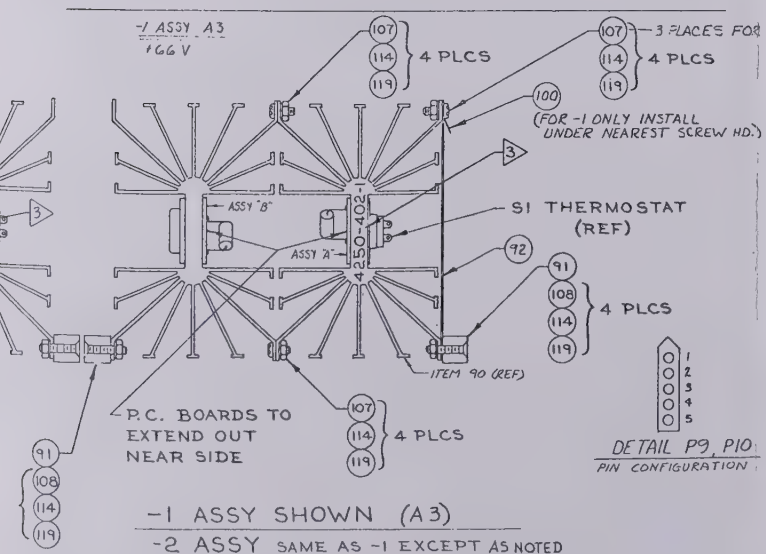
DETAIL D
S1 FOR ASSY A ONLY



ASSY B
CLAD SHOWN - NEARSIDE



ASSY A
CLAD SHOWN - NEARSIDE



DETAIL P9, P10
PIN CONFIGURATION

-1 ASSY SHOWN (A3)

-2 ASSY SAME AS -1 EXCEPT AS NOTED AND PER WIRE TAB TABLE (A4)

ASSY		WIRE TAB TABLE					
P9 A3-1	P10 A4-2	WIRE NO.	FROM PAD NO.	TO	WIRE GA & COLOR	"L" LENGTH IN INCHES	
—	—	1	—	—	—	—	
—	—	2	—	—	—	—	
X		3	A3-3	P9-5	#22 GREEN	14"	
	X	4	A4-3	P10-5	#22 GREEN	14"	
X		5	A3-4	P9-4	#22 W/GREEN	14"	
	X	6	A4-4	P10-4	#22 W/GREEN	14"	
X		7	A3-2A	P9-1	20 RED	6"	
	X	8	A4-6	P10-2	20 BLUE	19"	
X		9	A3-7	P9-2	20 ORANGE	20"	
	X	10	A4-7	P10-1	20 GREEN	20"	
X	X	11	8	CR1	18 BUSS	—	
—	—	12	—	—	—	—	
X	X	13	PAD 10	PAD 1	8 WHT	5" USE ITEM 95 RING LUG	FOR BOTH A3 & A4 ASSY
X	X	14	PAD 11	PAD 2	18 WHT	5" USE ITEM 95 RING LUG	
—	—	15	—	—	—	—	

ITEM NO.	PART NUMBER	PART NAME	MATERIAL — SPECIFICATION	CODE IDENT	FINISH	REF DES.	ZONE
REQD PER ASSY							
	PL4250-402-2	PARTS LIST	SEE SHT 3 THRU 6				
	PL4250-402-1	PARTS LIST	SEE SHT 3 THRU 6				

DIM IN INCHES TOLERANCES XXX = .010 XX = .03 X° = 30'
BREAK ALL SHARP CORNERS & EDGES TOUCH SURFACES ✓
DWG SIZE E

EXCEPT AS OTHERWISE PROVIDED BY CONTRACT, THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF CIC AND SHALL NOT BE REPRODUCED OR COPIED OR USED AS THE BASIS FOR THE MANUFACTURE OR SALE OF APPARATUS WITHOUT WRITTEN PERMISSION.

TITLE: OUTPUT HEATSINK ASSY -66V AND +66V

MODEL 2501T A4 & A3

CALIFORNIA INSTRUMENTS CORP SAN DIEGO, CALIFORNIA

CONTRACT NO. — CODE IDENT NO. 16067

DASH NO.	QTY REQD	NEXT ASSEMBLY	EFF ON	AUTH
-2	1	4250-400-1		
-1	1	4250-400-1		

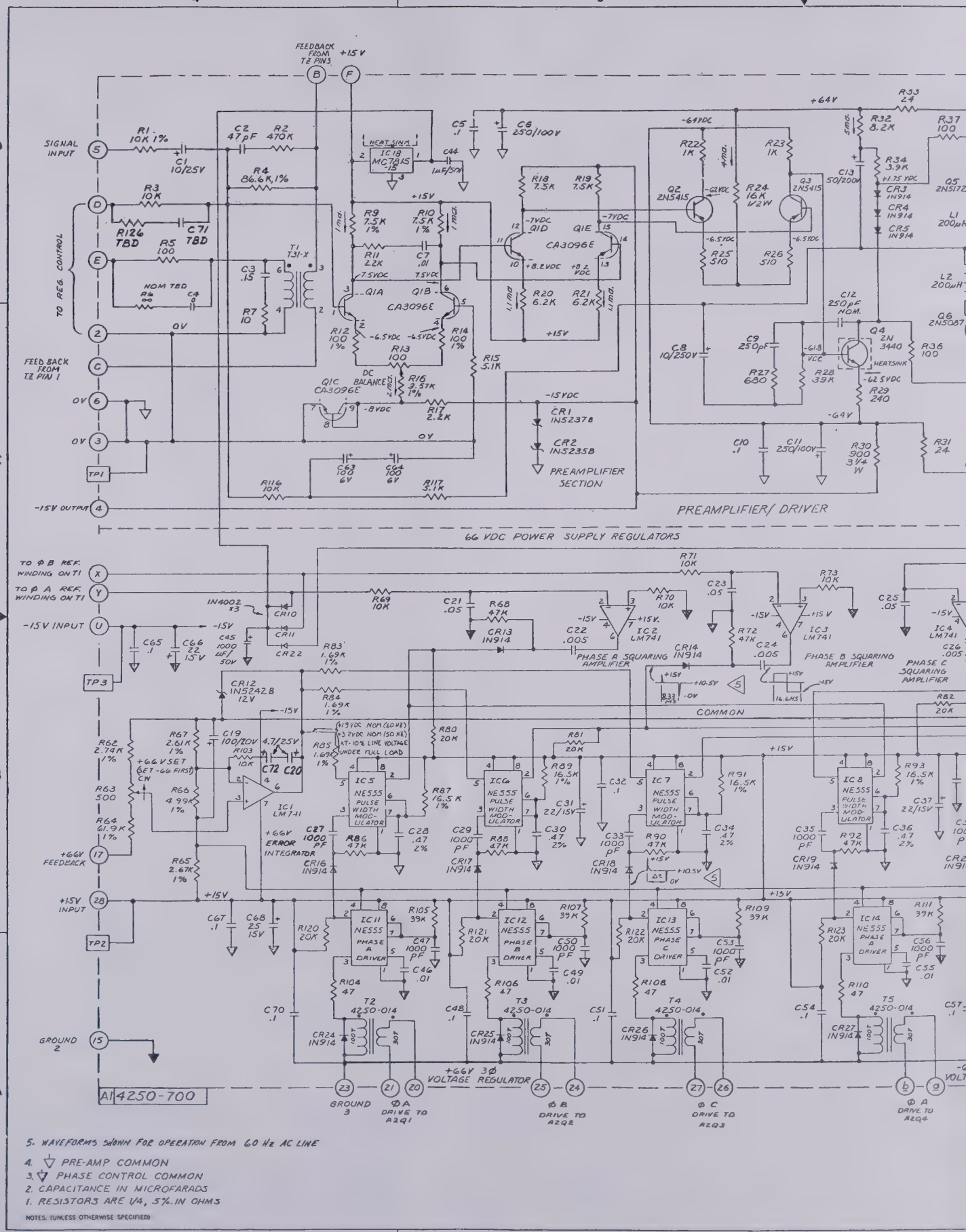
RELEASE — CHECKER — DESIGN — DRAFTSMAN J. LARA — PURCHASING — PROJ ENGR — CHF ENGR

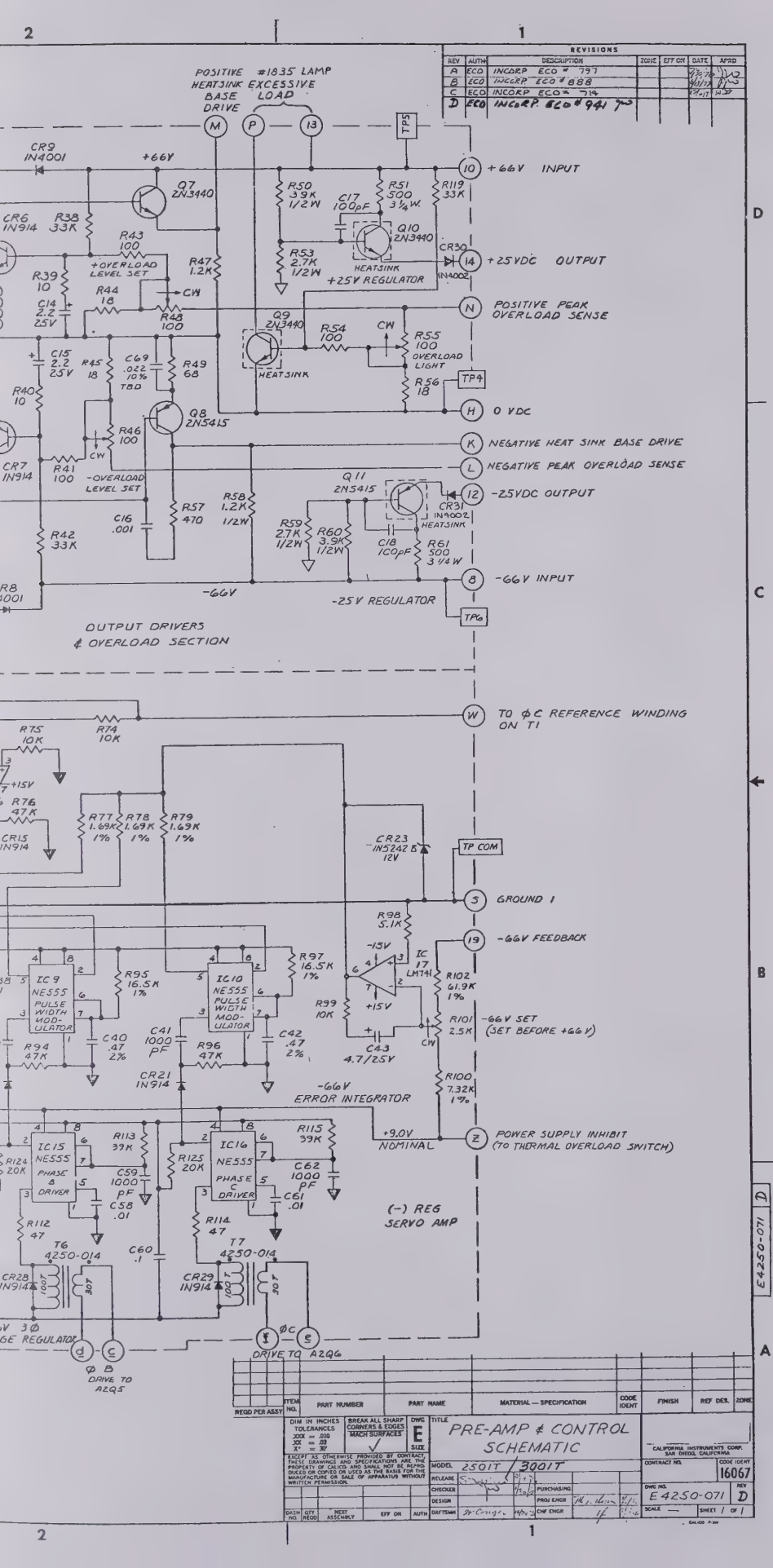
DWG NO. E4250-402 REV C

SCALE 2:1 SHEET 2 OF 6

4250-402 C

50


PREAMPLIFIER/ DRIVER
66 VDC POWER SUPPLY REGULATORS
PREAMPLIFIER SECTION
PHASE A SQUARING AMPLIFIER
PHASE B SQUARING AMPLIFIER
PHASE C SQUARING AMPLIFIER
+66V VOLTAGE REGULATOR
ERROR INTEGRATOR
A1 4250-700
5. WAVEFORMS SHOWN FOR OPERATION FROM 60 Hz AC LINE
4. PRE-AMP COMMON
3. PHASE CONTROL COMMON
2. CAPACITANCE IN MICROFARADS
1. RESISTORS ARE 1/4, 5% IN OHMS
NOTES: (UNLESS OTHERWISE SPECIFIED)


REVISIONS
REV AUTH DESCRIPTION ZONE EFF ON DATE APRD
A ECO INCORP ECO # 797
B ECO INCORP ECO # 888
C ECO INCORP ECO # 914
D ECO INCORP ECO # 941
POSITIVE HEATSINK BASE DRIVE
#1835 LAMP EXCESSIVE LOAD
TP5
CR9 IN4001
+66V
Q7 2N3440
R50 3.9K 1/2W
C17 100pF
R51 500 3 1/4W.
R119 33K
10 +66V INPUT
CR6 IN914
R38 33K
R43 100
+OVERLOAD LEVEL SET
R47 1.2K
Q10 2N3440
CR30
14 +25VDC OUTPUT
R53 2.7K 1/2W
HEATSINK
+25V REGULATOR
IN4002
R39 10
R44 18
CW
C14 2.2 25V
R48 100
N POSITIVE PEAK OVERLOAD SENSE
Q9 2N3440
R54 100
CW
R55 100 OVERLOAD LIGHT
HEATSINK
C15 2.2 25V
R45 18
C69 .022 10% TBD
R49 68
TP4
R56 18
H 0 VDC
R40 10
Q8 2N5415
R46 100
CW
K NEGATIVE HEAT SINK BASE DRIVE
CR7 IN914
R41 100
-OVERLOAD LEVEL SET
L NEGATIVE PEAK OVERLOAD SENSE
Q11 2N5415
12 -25VDC OUTPUT
CR31 IN4002
HEATSINK
R58 1.2K 1/2W
R57 470
C16 .001
R59 27K 1/2W
R60 3.9K 1/2W
C18 100pF
R61 500 3 1/4W
R42 33K
8 -66V INPUT
-66V
-25V REGULATOR
TP6
OUTPUT DRIVERS & OVERLOAD SECTION
W TO ØC REFERENCE WINDING ON T1
R75 10K
R74 10K
+15V
R76 47K
R77 1.69K 1%
R78 1.69K 1%
R79 1.69K 1%
CR15 IN914
CR23 IN5242B 12V
TP COM
3 GROUND 1
R98 5.1K
19 -66V FEEDBACK
-15V
IC 17 LM741
R102 61.9K 1%
IC 9 NE555 PULSE WIDTH MODULATOR
R95 16.5K 1%
IC 10 NE555 PULSE WIDTH MODULATOR
R97 16.5K 1%
R99 10K
+15V
R101 -66V SET (SET BEFORE +66V)
CW
C40 .47 2%
C41 1000 PF
R96 47K
C42 .47 2%
C43 4.7/25V
R94 47K
CR21 IN914
R100 7.32K 1%
-66V ERROR INTEGRATOR
+9.0V NOMINAL
Z POWER SUPPLY INHIBIT (TO THERMAL OVERLOAD SWITCH)
IC 15 NE555 PHASE & DRIVER
R113 39K
R115 39K
IC 16 NE555 PHASE C DRIVER
R125 20K
C59 1000 PF
C62 1000 PF
C58 .01
C61 .01
R112 47
R114 47
(-) REG SERVO AMP
T6 4250-014
T7 4250-014
C60 .1
CR28 IN914
CR29 IN914
100T
30T
3Ø GE REGULATOR
f ØC
e
DRIVE TO A2Q6
d
c
Ø B DRIVE TO A2Q5
ITEM NO. PART NUMBER PART NAME MATERIAL — SPECIFICATION CODE IDENT FINISH REF DES. ZONE
REQD PER ASSY
DIM IN INCHES TOLERANCES XXX = .010 XX = .03 X° = 30'
BREAK ALL SHARP CORNERS & EDGES MACH SURFACES
DWG SIZE E
TITLE PRE-AMP & CONTROL SCHEMATIC
CALIFORNIA INSTRUMENTS CORP. SAN DIEGO, CALIFORNIA
MODEL 250IT / 300IT
CONTRACT NO.
CODE IDENT 16067
DWG NO. E4250-071
REV D
SCALE —
SHEET 1 OF 1
RELEASE
CHECKER
DESIGN
DRAFTSMAN
PURCHASING
PROJ ENGR
CHF ENGR
DASH NO QTY REQD NEXT ASSEMBLY EFF ON AUTH
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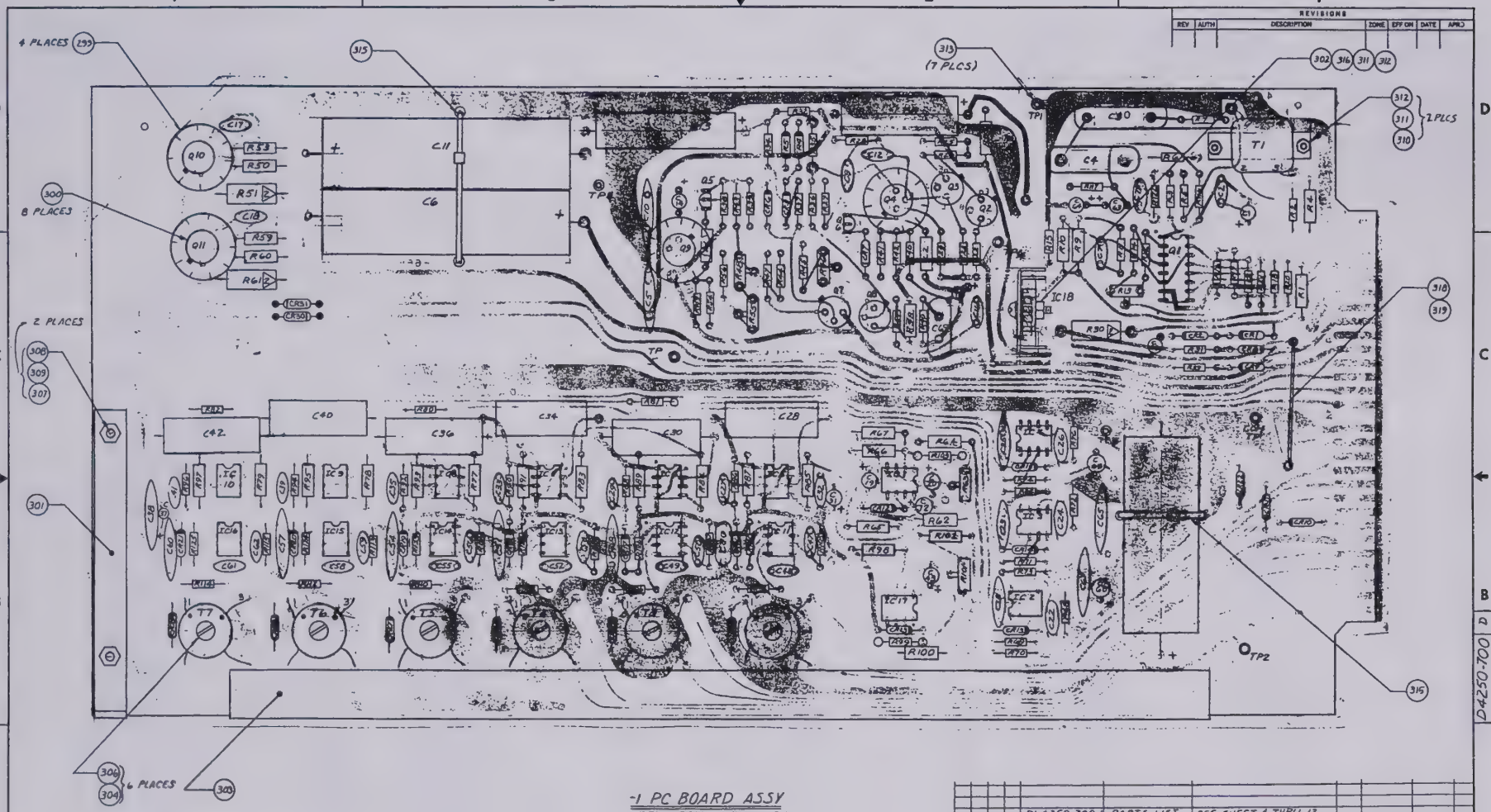
E4250-071 D



-1 PC BOARD ASSY
VIEW COMPONENT SIDE

REVISIONS

REV	AUTH	DESCRIPTION	ZONE	ECP OR	DATE	APRD

PL4250-700-1 PARTS LIST SEE SHEET 4 THRU 12

ITEM NO.	PART NUMBER	PART NAME	MATERIAL — SPECIFICATION	CODE IDENT	FINISH	REF DES.	ZONE

REQD PER ASSY

DIM IN INCHES
TOLERANCES
XXX = .010
XX = .03
X° = 30
BREAK ALL SHARP CORNERS & EDGES
MACH SURFACES

DWG SIZE D

TITLE
PRE-AMP & CONTROL
BOARD ASSY A1

MODEL 2501T

RELEASED			
CHECKED		PURCHASING	
DESIGN		FIELD ENGR	
DRAFTSMAN	W.B.L. 1/76	CHF ENGR	

CALIFORNIA INSTRUMENTS CORP.
SAN DIEGO, CALIFORNIA

CONTRACT NO.

CODE IDENT 16067

DWG NO. D 4250-700 REV D

SCALE 2/1 SHEET 2 OF 12

DASH NO.	QTY REQD	NEXT ASSEMBLY	ECP OR	AUTH
-1	1	E4250-400		

▷ INSTALL R51, R61, & R30 WITH .12 MIN. CLEARANCE TO BOARD

1. FOR SCHEMATIC DIAGRAM SEE E4250-071

NOTES: (UNLESS OTHERWISE SPECIFIED)

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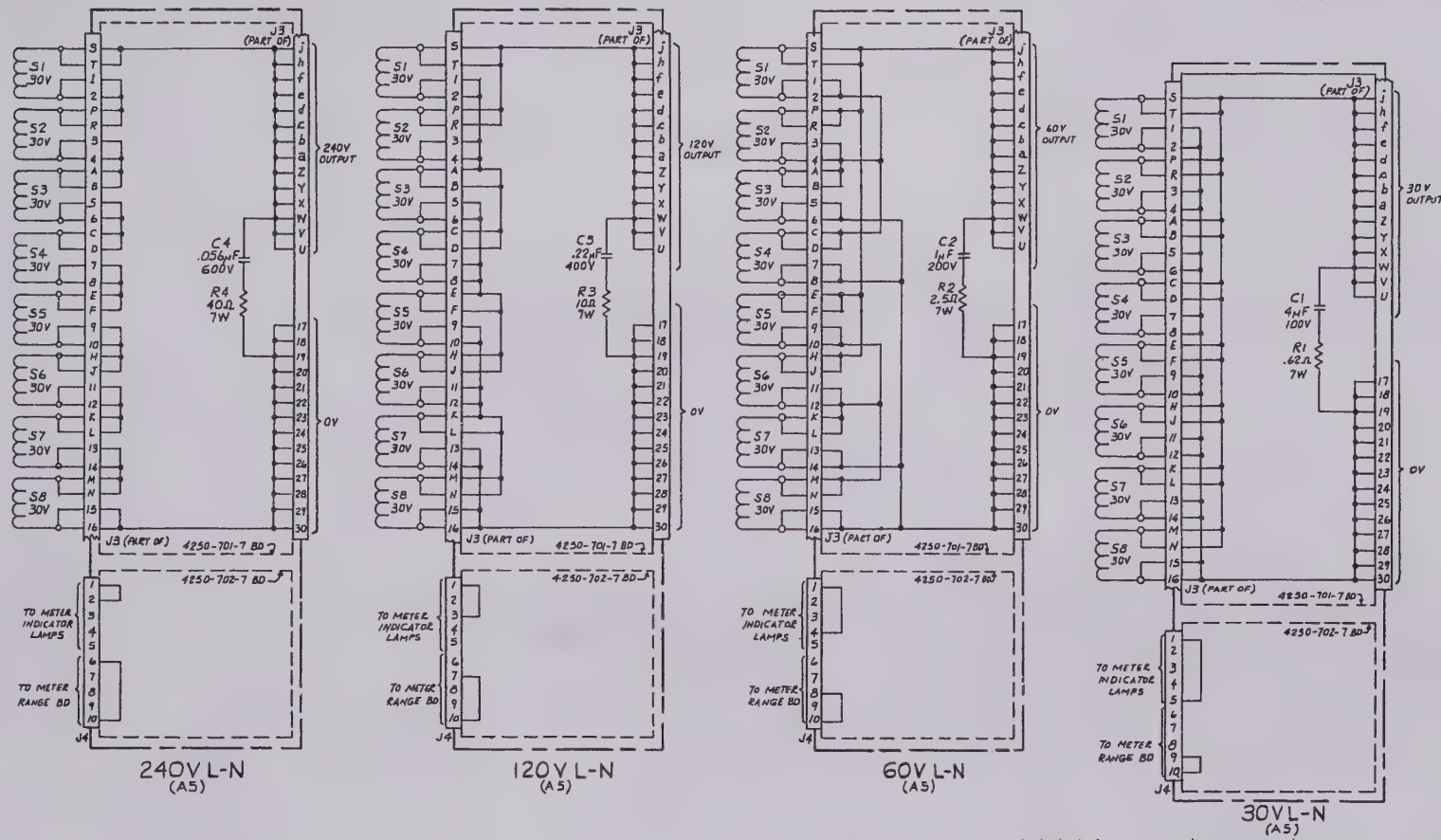
D4250-700 D



REVISIONS

REV	AUTH	DESCRIPTION	ZONE	EFF ON	DATE	APRO

REQD PER ASSY	ITEM NO.	PART NUMBER	PART NAME	MATERIAL — SPECIFICATION	CODE IDENT	FINISH	REF DES.	ZONE

DIM IN INCHES TOLERANCES .XXX = .010 .XX = .03 X° = 30' — BREAK ALL SHARP CORNERS & EDGES — MACH SURFACES ✓

EXCEPT AS OTHERWISE PROVIDED BY CONTRACT, THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF CALCO AND SHALL NOT BE REPRODUCED, COPIED OR USED AS THE BASIS FOR THE MANUFACTURE OR SALE OF APPARATUS WITHOUT WRITTEN PERMISSION.

DWG SIZE D

TITLE: SCHEMATIC DIAGRAM OUTPUT SELECTOR ASSY

MODEL 2501T

RELEASE S Modified 9/9/74

CHECKER

DESIGN

DRFTSMN M.MARTIN 7-11-75

PURCHASING

PROJ ENGR

CHF ENGR M. 9/11/75

CALIFORNIA INSTRUMENTS CORP. SAN DIEGO, CALIFORNIA

CONTRACT NO.

CODE IDENT 16067

DWG NO. D4250-072 REV —

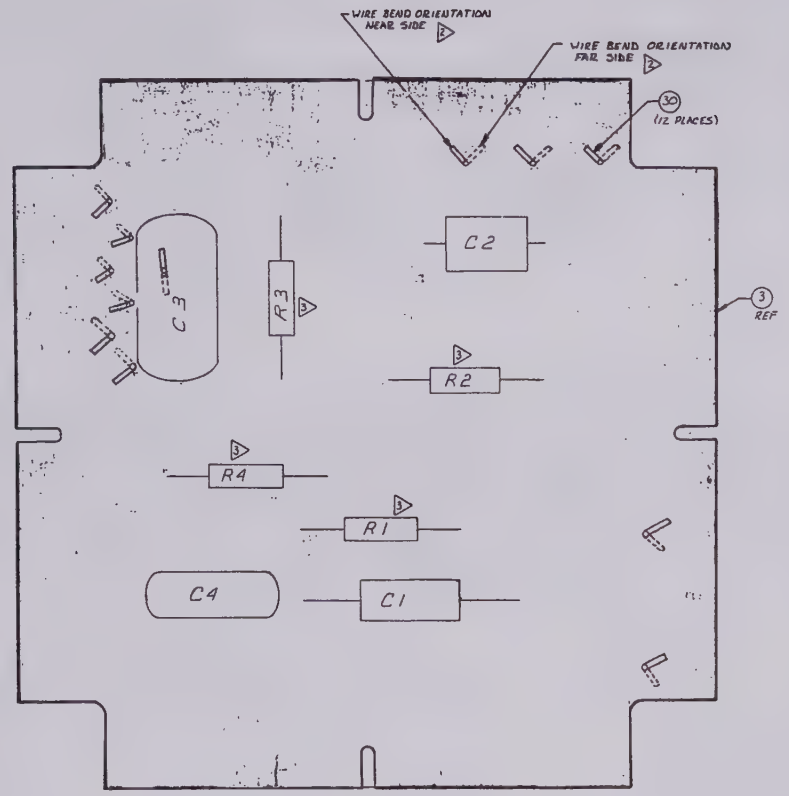
SCALE NONE SHEET OF

DASH NO. | QTY REQD | NEXT ASSEMBLY | EFF ON | AUTH

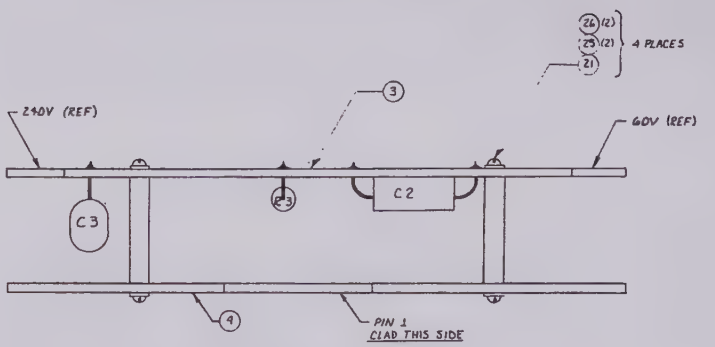
2. FOR UNIT SCHEMATIC DIAGRAM, SEE E4250-070.
1. FOR ASSEMBLY DWG, SEE D4250-404.

NOTES: (UNLESS OTHERWISE SPECIFIED)

D4250-072-—



COMPONENT SIDE OF ITEM NO. 3
(CLAD SHOWN IS NEAR SIDE)



-1 ASSY
NO SCALE

3 SPACE R1 THRU R4 1/4 OFF BOARD.

3 INSERT ITEM 30 & BEND EACH SIDE AS SHOWN. SOLDER TO CLAD BOTH SIDE.

1. FOR SCHEMATIC SEE DWG D9250-072

NOTES: (UNLESS OTHERWISE SPECIFIED)

REVISIONS						
REV	AUTH	DESCRIPTION	ZONE	EFF ON	DATE	APRD

PL 4250-404 PARTS LIST SEE SHEET 3

ITEM NO.	PART NUMBER	PART NAME	MATERIAL — SPECIFICATION	CODE IDENT	FINISH	REF DES.	ZONE
-1	4250-400	ASSY					

REQD PER ASSY

DIM IN INCHES TOLERANCES .XXX ± .010 .XX ± .03 X° ± 30'

BREAK ALL SHARP CORNERS & EDGES MACH SURFACES ✓

DWG SIZE D

TITLE: SELECTOR CARD ASSY A5

MODEL: 250 IT

RELEASE: S. Davidson 9/9/64

CHECKER: 9/6/64 PURCHASING

DESIGN: PROJ ENGR

DRFTSMN: J. Goetz 8-15-64 CHF ENGR 9/16/64

CALIFORNIA INSTRUMENTS CORP. SAN DIEGO, CALIFORNIA

CONTRACT NO. CODE IDENT 16067

DWG NO. D9250-404 REV -

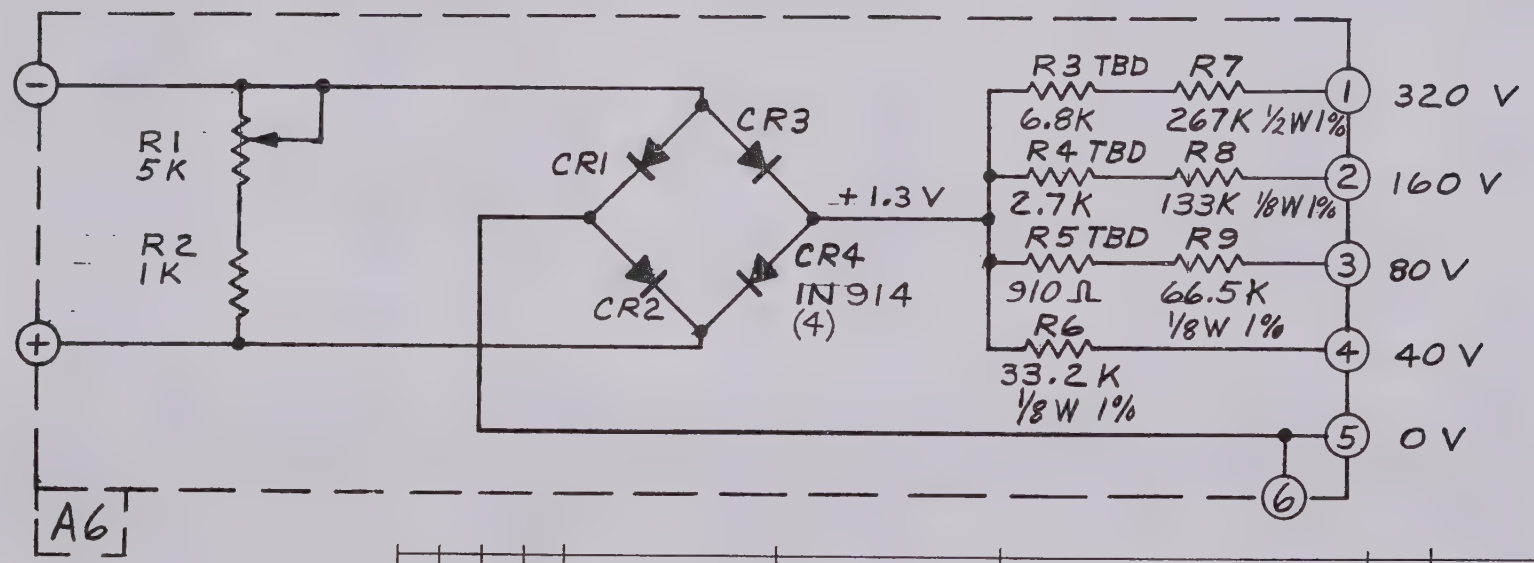
SCALE 2 x SHEET 2 OF 3

THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF CALICO AND SHALL NOT BE REPRODUCED OR COPIED OR USED AS THE BASIS FOR THE MANUFACTURE OR SALE OF APPARATUS WITHOUT WRITTEN PERMISSION.

D9250-404

B4050-072 A

REVISIONS						
REV	AUTH	DESCRIPTION	ZONE	EFF ON	DATE	APRD
A		ADDED EYELET NO.6 Danes			12/16/69	



REQD PER ASSY	ITEM NO.	PART NUMBER	PART NAME	MATERIAL — SPECIFICATION	CODE IDENT	FINISH	REF DES.	ZONE

3. PREFIX "A6" TO BE USED WITH ALL REF DES. (EXAMPLE: A6R1)
2. FOR ASSY SEE D4050-702
1. ALL RESISTORS ARE ¼W 5%

NOTES: (UNLESS OTHERWISE SPECIFIED)

DIM IN INCHES TOLERANCES
.XXX = .010
.XX = .03
X° = 30'

BREAK ALL SHARP CORNERS & EDGES
MACH SURFACES ✓

DWG SIZE B

EXCEPT AS OTHERWISE PROVIDED BY CONTRACT, THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF CALICO, AND SHALL NOT BE REPRODUCED OR COPIED OR USED AS THE BASIS FOR THE MANUFACTURE OR SALE OF APPARATUS WITHOUT WRITTEN PERMISSION.

DASH NO.	QTY REQD	NEXT ASSEMBLY	EFF ON	AUTH

TITLE
SCHEMATIC DIAGRAM VOLTMETER P.C. BD.

MODEL ALL "T" SERIES AC INVERTRONS

RELEASE	E. Shultz	11/7/69			
CHECKER	[illegible]	7/15/69	PURCHASING		
DESIGN			PROJ ENGR		
DRFTSMN	D. Danes	5/6/69	CHF ENGR		

CALIFORNIA INSTRUMENTS CORP.
SAN DIEGO, CALIFORNIA

CONTRACT NO.

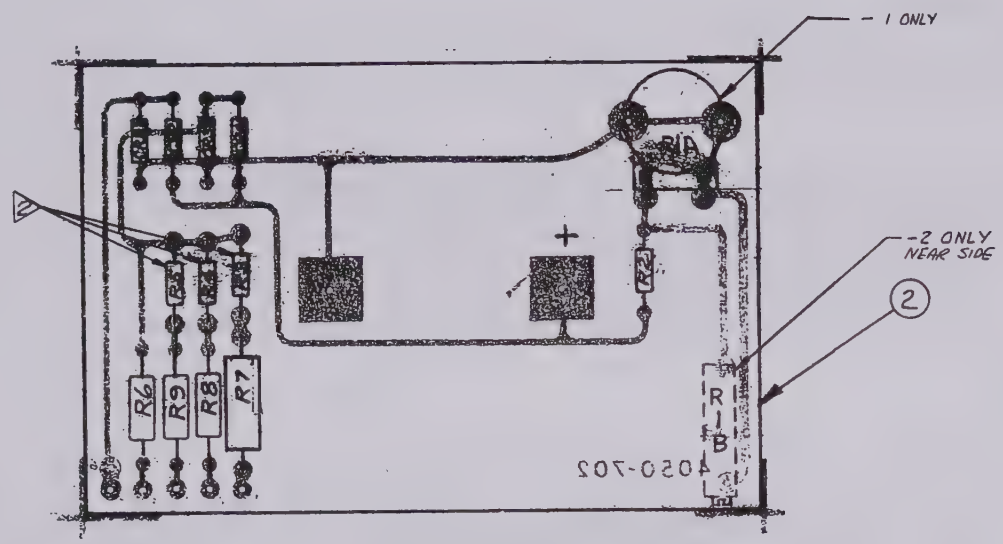
CODE IDENT 16067

DWG NO. B4050-072 REV A

SCALE NONE SHEET 1 OF 1

CALICO F-101

REVISIONS						
REV	AUTH	DESCRIPTION	ZONE	EFF ON	DATE	APRD



A6

-1 ASSEMBLY

VIEWED FROM COMPONENT SIDE

C4050-702 C

REQD PER ASSY	ITEM NO.	PART NUMBER	PART NAME	MATERIAL — SPECIFICATION	CODE IDENT	FINISH	REF DES.	ZONE
-1	/	PL 4050-702	PARTS LIST ON SHEET 4					

DIM IN INCHES TOLERANCES .XXX = .010 .XX = .03 X° = 30'

BREAK ALL SHARP CORNERS & EDGES MACH SURFACES ✓

DWG SIZE C

TITLE: VOLTMETER P.C. BOARD ASSY

MODEL: ALL A.C. POWER SOURCES (A6)

RELEASE: E Ewell 7/7/9

CHECKER: Wiener 7/15/9

DESIGN:

DRFTSMN: D. Daniel 6/7/9

PURCHASING

PROJ ENGR

CHF ENGR

CALIFORNIA INSTRUMENTS CORP. SAN DIEGO, CALIFORNIA

CONTRACT NO.

CODE IDENT 16067

DWG NO. C 4050-702 REV C

SCALE 2/1 SHEET 2 OF 4

CALICO F-102

EXCEPT AS OTHERWISE PROVIDED BY CONTRACT, THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF CALICO AND SHALL NOT BE REPRODUCED OR COPIED OR USED AS THE BASIS FOR THE MANUFACTURE OR SALE OF APPARATUS WITHOUT WRITTEN PERMISSION.

DASH NO.	QTY REQD	NEXT ASSEMBLY	EFF ON	AUTH

④ MOUNT R3, R4, & R5 FAR SIDE.

1. FOR SCHEMATIC SEE DWG NO. B 4050-072

NOTES: (UNLESS OTHERWISE SPECIFIED)

A6

REVISIONS						
REV	AUTH	DESCRIPTION	ZONE	EFF ON	DATE	APRD

C4250-704

-1 PC BOARD ASSY
CLAD & COMPONENTS ARE NEAR SIDE

REQD PER ASSY	ITEM NO.	PART NUMBER	PART NAME	MATERIAL — SPECIFICATION	CODE IDENT	FINISH	REF DES.	ZONE
		PL4250-704-1	PARTS LIST	SHEET 4				

DIM IN INCHES TOLERANCES XXX = .010 XX = .03 X° = 30'
BREAK ALL SHARP CORNERS & EDGES MACH SURFACES ✓
DWG SIZE C

EXCEPT AS OTHERWISE PROVIDED BY CONTRACT, THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF CALICO AND SHALL NOT BE REPRODUCED OR COPIED OR USED AS THE BASIS FOR THE MANUFACTURE OR SALE OF APPARATUS WITHOUT WRITTEN PERMISSION.

TITLE: CAPACITOR BUSS A7 BOARD ASSEMBLY

MODEL 2501T

RELEASE		9/9/76
CHECKER		9/10/76
DESIGN		
DRFTSMN		9/9/76

PURCHASING
PROJ ENGR
CHF ENGR 9/10/76

CALIFORNIA INSTRUMENTS a division of AEROJET INDUSTRIES, INC.

CONTRACT NO.
CODE IDENT 16067
DWG NO. C4250-704
REV /
SCALE 2/1
SHEET 2 OF 4

DASH NO.	QTY REQD	NEXT ASSEMBLY	EFF ON	AUTH
-1	1	4250-400		

CALICO F-102

(2) SPACE R1 & R2 1/8" OFF BOARD
1. FOR SCHEMATIC SEE E4250-070
NOTES: (UNLESS OTHERWISE SPECIFIED)

REPLACEABLE PARTS

7.1 GENERAL

This section contains ordering information and complete list of replaceable parts. Parts are listed by major assembly in alphanumerical order of their reference designators. Description, manufacturer's part number, manufacturer's code ident number (see Appendix A or list of manufacturer's), and CALIFORNIA INSTRUMENTS stock numbers are indicated.

7.2 ORDERING INFORMATION

In order to provide our customers with prompt service on replacement parts, please provide the following information, when applicable, for each part ordered:

a) Model number and serial number of the instrument,

b) CALIFORNIA INSTRUMENTS part number of the sub-assembly where component is located,

c) Component reference designator,

d) Component description,

e) Component manufacturer's number and code ident,

f) CALIFORNIA INSTRUMENTS stock number,

All replacement parts orders should be placed with CALIFORNIA INSTRUMENTS, A Norlin Technology Company, San Diego, California, 92111.

CALIFORNIA INSTRUMENTS CO. SAN DIEGO, CALIFORNIA	CODE IDENT 16067	PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
	4250-400-1	POWER SOURCE 2500VA	16067		1
	4250-400-2	POWER SOURCE 3000 VA	16067		2
	4250-400-3	POWER SOURCE 3.4KT-60	16067		3
A1	4250-700-1	PRE AMP AND REG BOARD	16067		4
A2	4250-401-1	RECTIFIER ASSEMBLY	16067		5
A3	4250-402-1	HEATSINK ASSEMBLY (+)	16067		6
A4	4250-402-2	HEATSINK ASSEMBLY (-)	16067		7
A5	4250-404-1	VOLT SELECTOR ASSY	16067		8
A6	4050-702-1	METER BOARD ASSEMBLY	16067		9
A7	4250-704-1	CAPACITOR BUSS BOARD	16067		10
A3	4250-414-1	HEATSINK ASSEMBLY (+)	16067		11
A4	4250-414-2	HEATSINK ASSEMBLY (-)	16067		12
A5	4250-415-1	VOLTAGE SELECTOR ASSY	16067		13
B1	WS2107F	FAN (115 CFM)	23936	2-41063	14
B2	7600S	FAN (265 CFM)	23936	2-10055	15
B3	7600S	FAN (265 CFM)	23936	2-10055	16
B1	7600S	FAN (265 CFM)	23936	2-10055	17
C1	500273U075DF2B	CAPACITOR 27000μF 75V	00853	6-10992	18
C2	500273U075DF2B	CAPACITOR 27000μF 75V	00853	6-10992	19
C3	500273U075DF2B	CAPACITOR 27000μF 75V	00853	6-10992	20
C4	500273U075DF2B	CAPACITOR 27000μF 75V	00853	6-10992	21
C5	B2A205J	CAPACITOR 2μF 200V	12406	6-11018	22
C6	ZD2A106	CAPACITOR 10μF 200V	12406	6-11002	23
C7	ZD2A106	CAPACITOR 10μF 200V	12406	6-11002	24
CB1	CF3-G3-U-20-240-3	CIRCUIT BREAKER	74193	2-70025	25
CB1	CF3-G3-U-25-240-3	CIRCUIT BREAKER	74193	2-70081	26
C1	FAHM36000-75-D6	CAPACITOR 36000μF 75V	14655	6-11067	27
C2	FAHM36000-75-D6	CAPACITOR 36000μF 75V	14655	6-11067	28
C3	FAHM36000-75-D6	CAPACITOR 36000μF 75V	14655	6-11067	29
C4	FAHM36000-75-D6	CAPACITOR 36000μF 75V	14655	6-11067	30
					31
DS1	NE51H (B2A)	LAMP, NEON	71744	2-41107	32
DS2	1819	LAMP, INCANDESCENT	03507	2-41028	33
DS3	BG03-RCS-NE2H/33K	LAMP, INDICATOR	03797	2-41022	34
DS4	BG03-RCS-NE2H/33K	LAMP, INDICATOR	03797	2-41022	35
DS5	BG03-RCS-NE2H/33K	LAMP, INDICATOR	03797	2-41022	36

MODEL	2501T/3001T	CALICO P/N 4250-400		ASSY R.D.
TITLE	POWER SOURCE ASSEMBLY 2500VA/3000VA		SHT 4 OF 10	

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
DS6	BG03-RCS-NE2H/33K	LAMP, INDICATOR	03797	2-41022	37
DS7	1835	LAMP, INCANDESCENT 55V	03507	2-50304	38
					39
XDS1	135-0463-1433-221	LAMP, HOLDER	72619	2-41113	40
XDS2	135-0410-1471-201	LAMP, HOLDER	72619	2-41112	41
XDS3 THRU XDS6 NOT USED					42
XDS7	135-0410-1471-201	LAMP, HOLDER	72619	2-41112	43
					44
FL1	4250-012	FILTER REACTOR	16067	7-10290	45
FL2	4250-012	FILTER REACTOR	16067	7-10290	46
FL1	4250-025	FILTER REACTOR	16067	7-10321	47
FL2	4250-025	FILTER REACTOR	16067	7-10321	48
J1	8BDJ-10S-0	CONNECTOR	81312	4-10260	49
J2	8BD-28S-0	CONNECTOR	81312	4-10178	50
J3	8BD-30S-0	CONNECTOR	81312	4-10262	51
J4	8BD-10S-0	CONNECTOR	81312	4-10032	52
J5	5284	OUTLET	74545	4-10263	53
J6	DF-31-RC	BINDING POST	58474	2-40041	54
J7	DF-31-WTC	BINDING POST	58474	2-40090	55
J8	DF-31-BC	BINDING POST	58474	2-40040	56
J9	03-06-1055	CONNECTOR 5 PIN	27264	4-10220	57
J10	03-06-1055	CONNECTOR 5 PIN	27264	4-10220	58
M1	CIC 800-2	METER	16067	2-50104	59
					60
					61
R1	4010-012-1	POT 10K	16067	5-70128	62
R2	4530	RESISTOR 1Ω 5W	44655	5-50003	63
R3	F315	RESISTOR 250Ω 30W	44655	5-50211	64
R4	F315	RESISTOR 250Ω 30W	44655	5-50211	65
R5	RH50-73-.02Ω	RESISTOR .02Ω 50W	91637	5-50184	66
R6	RH50-73-.02Ω	RESISTOR .02Ω 50W	91637	5-50184	67
R7	NOT USED	RESISTOR			68
R8	NOT USED	RESISTOR			69
R9	89PBR-100Ω	POT 100Ω	73138	5-70252	70
					71
					72

MODEL	2501T/3001T	CALICO P/N	4250-400	ASSY R.D.
TITLE	POWER SOURCE ASSEMBLY 2500VA/3000VA	SHT 5	OF 10	

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
T1	4250-011	TRANSFORMER, POWER	16067	7-10289	73
T2	4250-010	TRANSFORMER, OUTPUT	16067	7-10287	74
T1	4250-026	TRANSFORMER, POWER	16067	7-10322	75
T2	4250-024	TRANSFORMER, OUTPUT	16067	7-10320	76
TB1	410Y-12	TERMINAL BLOCK	75382	2-41123	77
TB2	9-85-5	TERMINAL BLOCK	75382	2-50172	78
TB3	605-2	TERMINAL BLOCK	75382	2-50302	79
TB4	3003	TERMINAL STRIP	83330	2-50050	80
TB5	3002	TERMINAL STRIP	83330	2-50111	81
TB6	901	TERMINAL STRIP	83330	2-50086	82
TB7 THRU TB9 NOT USED					83
TB10	9-85-3	TERMINAL BLOCK	75382	2-40321	84
	4250-229-1	ENCLOSURE	16067	1-10663	85
	4250-201-2	FRONT PANEL	16067	1-10577	86
	4250-200-1	ENCLOSURE	16067	1-10576	87
	4250-201-1	FRONT PANEL	16067	1-10577	88
	4250-202-7	REAR PANEL	16067	1-10585	89
	4250-203-7	COVER, TOP	16067	1-10586	90
	4250-204-7	COVER, BOTTOM	16067	1-10587	91
	4250-210-1	BRACKET, H/S MTG	16067	1-10588	92
	4250-211-1	BRACKET, H/S MTG	16067	1-10589	93
	4250-213-7	CAGE, VOLT SELECTOR	16067	1-10590	94
	4250-214-7	GUIDE, BOARD	16067	2-10608	95
	4250-216-7	COVER, VOLT SELECTOR	16067	1-10591	96
	4250-217-7	INSULATOR, HEATSINK	16067	2-10609	97
	4250-219-7	BRACKET, CONNECTOR	16067	1-10592	98
	4250-230-7	REAR PANEL	16067	1-10664	99
	4100-218-1	SUPPORT, COVER	16067	1-10194	100
	1360-217-9	SPACER, RESISTOR	16067	1-10117	101
	1412-4	SOLDER LUG	83330	2-50115	102
	FCA-3	HANDLE	08730	2-40224	103
	33-9016-12-01-04	GUIDE, CARD	91662	2-41124	104
	PS70-2-BLK	KNOB	21604	2-40233	105
	CMC 48	CLAMP, MTG, CAP.	56289	2-41052	106
	2170	GROMMET	83330	2-10119	107
	2186	GROMMET	83330	2-10611	108

MODEL 2501T/3001T	CALICO P/N 4250-400		ASSY R.D.
TITLE POWER SOURCE ASSEMBLY 2500VA/3000VA		SHT 6 OF 10	

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
	2187	GROMMET	83330	2-10089	109
	10650	LAMP RETAINER	03797	2-41025	110
	C8020-632	SPEED NUT	78553	2-10091	111
	550481	FINGER GUARD	82877	2-41064	112
	5506	FINGER GUARD	23936	2-10074	113
	1416-8	SOLDER LUG	83330	2-50053	114
	MS9352-11	CLAMP	18076	2-10617	115
	773	CABLE CLAMP 1/4 I.D.	83330	2-10153	116
	772	CABLE CLAMP 3/16 I.D.	83330	2-10366	117
	2693	CATERPILLAR NYLON GROM	83330		118
	410J	JUMPER	75382	2-50090	119
	4-40 X 5/8	SCREW, PAN HEAD			120
	4-40 x 1/2	SCREW, PAN HEAD			121
	8248	SPACER	83330	2-10496	122
	6-32 X 1/4	SCREW, PAN HEAD			123
	6-32 X 5/16	SCREW, PAN HEAD			124
					125
	6-32 X 7/16	SCREW, PAN HEAD			126
	6-32 X 5/8	SCREW, PAN HEAD			127
	6-32 X 7/8 LG	SCREW, PAN HEAD			128
	8-32 X 5/16	SCREW, PAN HEAD			129
	8-32 X 5/8	SCREW, PAN HEAD			130
	8-32 X 3/4	SCREW, PAN HEAD			131
	8-32 X 7/8	SCREW, PAN HEAD			132
	10-32 x 3/8	SCREW, PAN HEAD			133
					134
	1/4 - 20 X 1/2	SCREW, HEX HEAD	81349	2-10271	135
	1561	CONNECTOR PIN FEMALE	27264	4-10221	136
					137
	6-32 X 3/8	SCREW, FLAT HEAD			138
					139
					140
	8-32 X 5/8	SCREW, FLAT HEAD			141
	8-32 X 1-1/4	SCREW, FLAT HEAD	81349	2-10612	142
	2172	GROMMET	83330	2-10105	143
	1647	BOARD SUPPORT	91833	1-10597	144

MODEL 2501T/3001T | CALICO P/N 4250-400 | ASSY R.D.

TITLE POWER SOURCE ASSEMBLY 2500VA/3000VA | SHT 7 OF 10

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
	10-32 X 1/2	SCREW, FLAT HEAD			145
	10-32 X 3" LG.	SCREW, ROUND HD.	81349	2-10644	146
					147
	8-32 X 1-1/4	SCREW, ROUND HEAD	81349	2-10613	148
					149
					150
	#6	WASHER, FLAT			151
	#8	WASHER, FLAT			152
	MS15795-310	WASHER, FLAT 1/4 LARGE	81349	2-10097	153
					154
					155
	#4	WASHER, INT STR			156
	#6	WASHER, INT STR			157
	#8	WASHER, INT STR			158
	#10	WASHER, INT STR			159
					160
					161
					162
					163
					164
	#1/4	WASHER, SPLIT LOCK	81349	2-10459	165
					166
					167
	#4-40	NUT, HEX			168
	#6-32	NUT, HEX			169
	#8-32	NUT, HEX			170
	#10-32	NUT, HEX			171
	#1/4 -20x7/16HEX	NUT, HEX	81349	2-10298	172
					173
					174
					175
	RTV 108	SILICON RUBBER ADHESIVE	03507		176
	WTCM-1	MOUNT PLATE, WIRE TIE	51705		177
	WRN-3-1/2	WIRE TIE	51705		178
					179
					180

MODEL	2501T/3001T	CALICO P/N	4250-400	ASSY R.D.
TITLE	POWER SOURCE ASSEMBLY 2500VA/3000VA	SHT 8	OF 10	

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
	R5001	RING LUG 4 STUD 1/4	14726		181
	R4001	RING LUG 6 STUD 10	14726		182
	R3031	RING LUG 8 STUD 10	14726		183
	R4162	RING LUG 16-14 STUD 1/4	14726		184
	R4149	RING LUG 22-18 STUD 10	14726		185
	R4170	RING LUG 12-10 STUD 10	14726		186
	R4171	RING LUG 12-10 STUD 1/4	14726		187
	R4161	RING LUG 16-14 STUD 10	14726		188
	R4150	RING LUG 22-18 STUD 1/4	14726		189
	R4158	RING LUG 16-14 STUD 6	14726		190
	R4183	RING LUG 12-10 STUD 6	14726		191
	R4142	RING LUG 22-18 STUD 6	14726		192
	BS41270SB	BLOCK SPADE LUG 16-14 STUD 4	14726		193
					194
					195
	.015THK.x 5" x 5"	FISH PAPER	81349		196
					197
					198
					199
					200
					201
					202
					203
					204
					205
					206
					207
					208
					209
					210
					211
					212
					213
					214
					215
					216

MODEL	2501T/3001T	CALICO P/N	4250-400	ASSY R.D.
TITLE	POWER SOURCE ASSEMBLY 2500VA/3000VA	SHT 9	OF 10	

Aiken Industries California Instruments Division | CODE IDENT 16067 | **PARTS LIST**

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
					217
A6	4050-702-3	METER BOARD ASSEMBLY	16067		218
					219
M1	C1C800-37	METER	16067	2-50104	220
					221
T2	4250-027	TRANSFORMER, OUTPUT	16067	7-10323	222
					223
TB3	605-3	TERMINAL BLOCK	75382	2-50330	224
TB10	9-85-4	TERMINAL BLOCK	75382	2-50331	225
					226
	4250-233-1	ENCLOSURE	16067	1-10669	227
	4250-231-1	FRONT PANEL	16067	1-10670	228
	4250-232-7	REAR PANEL	16067	1-10671	229
					230
	4815-700-109	PCB ASSY-60HZ, 1Φ	16067	1-60109	231

MODEL 3.4KT-60	CALICO P/N 4250-400		ASSY R.D.
TITLE POWER SOURCE ASSEMBLY		SHT 10 OF 10	

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A2	D4250-401-1	RECTIFIER ASSEMBLY	16067	-	1
					2
A2C1	5 HK-P10	CAPACITOR . 1μF 500V	56289	6-10821	3
A2CR1	1N1188A	RECTIFIER	95303	3-10221	4
A2CR2	1N1188A	RECTIFIER	95303	3-10221	5
A2CR3	1N1188A	RECTIFIER	95303	3-10221	6
A2CR4	1N1186RA	RECTIFIER	95303	3-10192	7
A2CR5	1N1188A	RECTIFIER	95303	3-10221	8
A2CR6	1N1188A	RECTIFIER	95303	3-10221	9
A2CR7	1N1188A	RECTIFIER	95303	3-10221	10
A2CR8	1N1186RA	RECTIFIER	95303	3-10192	11
					12
					13
A2Q1	NL-578D	SCR	27014	3-30287	14
A2Q2	NL-578D	SCR	27014	3-30287	15
A2Q3	NL-578D	SCR	27014	3-30287	16
A2Q4	NL-578D	SCR	27014	3-30287	17
A2Q5	NL-578D	SCR	27014	3-30287	18
A2Q6	NL-578D	SCR	27014	3-30287	19
	R4161	RING LUG 16-14/STUD 10	14726		20
	R4170	RING LUG 12-10/STUD 10	14726		21
	C4250-206-7	HEATSINK	16067	2-10600	22
	C4250-207-7	HEATSINK	16067	2-10601	23
	C4250-208-7	INSULATOR	16067	2-10602	24
	B4250-209-7	BRACKET	16067	1-10578	25
	147	SOLDER LUG, RIGHT ANGLE	0000Z	2-50295	26
	#4-40 x 5/16 LG	SCREW, PAN HEAD	-	-	27
	#4	WASHER, INT. STR.	-	-	28
	#4-40	NUT, 3/16 HEX	-	-	29
#6- x 3/8 LG, TYPE B; SELF		TAP PAN HEAD SCREW	45722	2 10231	30
	#8-32 x 5/8 LG	SCREW, PAN HEAD	-	-	31
	#8	WASHER, INT. STR.	-	-	32
	#8-32	NUT	-	-	33
	1414-10	SOLDER LUG	83330	2-50170	34
	#10-32 x 5/16 LG	SCREW			35
	#10	WASHER INT. STR.			36

MODEL	2501T	CALICO P/N	4250-401	ASSY R.D.
TITLE	3 PHASE POWER RECTIFIER ASSY	SHT 3	OF 3	A2

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A3	E4250-402-1	OUTPUT HEATSINK ASSY +66V	16067	-	1
A4	E4250-402-2	OUTPUT HEATSINK ASSY -66V	16067	-	2
	4250-703-7	P.C. BOARD	16067	1-60250	3
					4
					5
A3CR1	1N1186A	DIODE	95303	3-10167	6
					7
A3Q1	DTS-410	TRANSISTOR	16758	3-30020	8
A3Q2	67334 2N6259	TRANSISTOR	95303	3-30281	9
A3Q3	67334	TRANSISTOR	95303	3-30281	10
A3Q4	67334	TRANSISTOR	95303	3-30281	11
A3Q5	67334	TRANSISTOR	95303	3-30281	12
A3Q6	67334	TRANSISTOR	95303	3-30281	13
A3Q7	67334	TRANSISTOR	95303	3-30281	14
A3Q8	67334	TRANSISTOR	95303	3-30281	15
A3Q9	67334	TRANSISTOR	95303	3-30281	16
A3Q10	67334	TRANSISTOR	95303	3-30281	17
A3Q11	67334	TRANSISTOR	95303	3-30281	18
A3Q12	67334	TRANSISTOR	95303	3-30281	19
A3Q13	67334	TRANSISTOR	95303	3-30281	20
A3Q14	67334	TRANSISTOR	95303	3-30281	21
A3Q15	67334	TRANSISTOR	95303	3-30281	22
A3Q16	67334	TRANSISTOR	95303	3-30281	23
A3Q17	67334	TRANSISTOR	95303	3-30281	24
					25
A3R1	RC20GF151J	RESISTOR 150Ω 5% 1/2 W	81349	5-20021	26
A3R2	RC20GF100J	RESISTOR 10Ω 5% 1/2W	81349	5-20006	27
A3R3	RW59VR10WL	RESISTOR .1Ω 5% 3W	63743	5-50188	28
A3R4	RW59VR10WL	RESISTOR .1Ω 5% 3W	63743	5-50188	29
A3R5	RW59VR10WL	RESISTOR .1Ω 5% 3W	63743	5-50188	30
A3R6	RW59VR10WL	RESISTOR .1Ω 5% 3W	63743	5-50188	31
A3R7	RW59VR10WL	RESISTOR .1Ω 5% 3W	63743	5-50188	32
A3R8	RW59VR10WL	RESISTOR .1Ω 5% 3W	63743	5-50188	33
A3R9	RW59VR10WL	RESISTOR .1Ω 5% 3W	63743	5-50188	34
A3R10	RW59VR10WL	RESISTOR .1Ω 5% 3W	63743	5-50188	35
A3R11	RW59VR10WL	RESISTOR .1Ω 5% 3W	63743	5-50188	36

MODEL	CALICO P/N	ASSY R.D.
2501T	4250-402	A3/A4

TITLE	SHT	OF
OUTPUT HEATSINK ASSEMBLY -66V and +66V	3	6

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A3R12	RW59VR10WL	RESISTOR . 1Ω 5% 3W	63743	5-50188	37
A3R13	RW59VR10WL	RESISTOR . 1Ω 5% 3W	63743	5-50188	38
A3R14	RW59VR10WL	RESISTOR . 1Ω 5% 3W	63743	5-50188	39
A3R15	RW59VR10WL	RESISTOR . 1Ω 5% 3W	63743	5-50188	40
A3R16	RW59VR10WL	RESISTOR . 1Ω 5% 3W	63743	5-50188	41
A3R17	RW59VR10WL	RESISTOR . 1Ω 5% 3W	63743	5-50188	42
A3R18	RW59VR10WL	RESISTOR . 1Ω 5% 3W	63743	5-50188	43
					44
					45
A3S1	3450-87-149	THERMOSTAT	14604	2-70066	46
					47
A4CR1	1N1186A	DIODE	95303	3-10167	48
					49
A4Q1	DTS-410	TRANSISTOR	16758	3-30020	50
A4Q2	2N6259	TRANSISTOR	95303	3-30281	51
A4Q3	2N6259	TRANSISTOR	95303	3-30281	52
A4Q4	2N6259	TRANSISTOR	95303	3-30281	53
A4Q5	2N6259	TRANSISTOR	95303	3-30281	54
A4Q6	2N6259	TRANSISTOR	95303	3-30281	55
A4Q7	2N6259	TRANSISTOR	95303	3-30281	56
A4Q8	2N6259	TRANSISTOR	95303	3-30281	57
A4Q9	2N6259	TRANSISTOR	95303	3-30281	58
A4Q10	2N6259	TRANSISTOR	95303	3-30281	59
A4Q11	2N6259	TRANSISTOR	95303	3-30281	60
A4Q12	2N6259	TRANSISTOR	95303	3-30281	61
A4Q13	2N6259	TRANSISTOR	95303	3-30281	62
A4Q14	2N6259	TRANSISTOR	95303	3-30281	63
A4Q15	2N6259	TRANSISTOR	95303	3-30281	64
A4Q16	2N6259	TRANSISTOR	95303	3-30281	65
A4Q17	2N6259	TRANSISTOR	95303	3-30281	66
					67
A4R1	RC20GF151J	RESISTOR 150Ω 5% 1/2 W	81349	5-20021	68
A4R2	RC20GF100J	RESISTOR 10Ω 5% 1/2 W	81349	5-20006	69
A4R3	RW59VR10WL	RESISTOR . 1Ω 5% 3W	63743	5-50188	70
A4R4	RW59VR10WL	RESISTOR . 1Ω 5% 3W	63743	5-50188	71
A4R5	RW59VR10WL	RESISTOR . 1Ω 5% 3W	63743	5-50188	72

MODEL	2501T	CALICO P/N	4250-402		ASSY R.D.
TITLE	OUTPUT HEATSINK ASSY -66V and +66V			SHT 4 OF 6	A3/A4

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A4R6	RW59VR10WL	RESISTOR . 1Ω 5% 3W	63743	5-50188	73
A4R7	RW59VR10WL	RESISTOR . 1Ω 5% 3W	63743	5-50188	74
A4R8	RW59VR10WL	RESISTOR . 1Ω 5% 3W	63743	5-50188	75
A4R9	RW59VR10WL	RESISTOR . 1Ω 5% 3W	63743	5-50188	76
A4R10	RW59VR10WL	RESISTOR . 1Ω 5% 3W	63743	5-50188	77
A4R11	RW59VR10WL	RESISTOR . 1Ω 5% 3W	63743	5-50188	78
A4R12	RW59VR10WL	RESISTOR . 1Ω 5% 3W	63743	5-50188	79
A4R13	RW59VR10WL	RESISTOR . 1Ω 5% 3W	63743	5-50188	80
A4R14	RW59VR10WL	RESISTOR . 1Ω 5% 3W	63743	5-50188	81
A4R15	RW59VR10WL	RESISTOR . 1Ω 5% 3W	63743	5-50188	82
A4R16	RW59VR10WL	RESISTOR . 1Ω 5% 3W	63743	5-50188	83
A4R17	RW59VR10WL	RESISTOR . 1Ω 5% 3W	63743	5-50188	84
A4R18	RW59VR10WL	RESISTOR . 1Ω 5% 3W	63743	5-50188	85
					86
A4S1	3450-87-149	THERMOSTAT	14604	2-70066	87
					88
					89
	D4250-205-7	HEATSINK	16067	2-10604	90
	C4250-212-7	ADAPTOR	16067	1-10579	91
	B4250-220-7	SIDE INSULATOR HEAT SINK	16067	2-10610	92
	1700 ME	TERMINAL	00866	2-50057	93
	NY04-040	SHOULDER BUSHING	08289	2-10076	94
	THERMATE	COMPOUND, SILICONE	-	-	95
	DM-123	WASHER, MICA	08289	3-30192	96
	B-500+	WIRE MARKER	53209	-	97
	AWG14	SLEEVING TEFLON	-	-	98
	AWG16	BUSS WIRE	-	-	99
	1412-6	SOLDER LUG	83330	2-50223	100
					101
	2-56 x 1/4 LG	SCREW, PAN HEAD	81349	2-10283	102
					103
	#4- 40 x 5/16 LG	SCREW, PAN HEAD	-	-	104
	#4- 40 x 3/4 LG	SCREW, PAN HEAD	-	-	105
					106
	#6- 32 x 5/16 LG	SCREW, PAN HEAD	-	-	107
	#6- 32 x 3/4 LG	SCREW, FLAT HEAD, 100°	-	-	108

MODEL 2501T | CALICO P/N 4250-402 | ASSY R.D.

TITLE OUTPUT HEATSINK ASSEMBLY -66V and +66V | SHT 5 OF 6 | A3/A4

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
	#8- 32 x 3/4 LG	SCREW, PAN HEAD			109
					110
	#4	WASHER, INT. STR			111
	#4	WASHER, SPLIT LOCK			112
					113
	#6	WASHER, INT STR			114
					115
	#8	WASHER, INT STR			116
					117
	#4-40	NUT, HEX			118
	#6-32	NUT, HEX			119
	#8-32	NUT, HEX			120
					121
					122
	R3031	RING LUG #8/STUD #10	14726		123
	R4149	RING LUG #18/STUD #10	14726		124
					125
A3P1	A3P8 NOT USED IN	THIS ASSY			126
A3P9	1625-5-P-1	CONNECTOR 5 PIN	27264	4-10224	127
A3P10	1625-5-P-1	CONNECTOR 5 PIN	27264	4-10224	128
					129
					130
	02-06-2103	CONNECTOR PIN MALE	27264	4-10225	131
					132
					133
					134
					135
					136
					137
					138
					139
					140
					141
					142
					143
					144

MODEL 2501T	CALICO P/N 4250-402		ASSY R.D.
TITLE OUTPUT HEATSINK ASSEMBLY -66V and +66V		SHT 6 OF 6	A3/A4

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
	4250-404-1	SELECTOR ASSEMBLY	16067		1
					2
	4250-701-7	VOLTAGE CARD	16067	1-60249	3
	4250-702-7	RANGE CARD	16067	1-60248	4
					5
					6
					7
A5C1	ZD1A405	CAPACITOR 4μF 100V	12406	6-11016	8
A5C2	ZD2A105K	CAPACITOR 1μF 200V	12406	6-10591	9
A5C3	4DP-5-224	CAPACITOR .22μF 400V	72136	6-11015	10
A5C4	6DP-3-563	CAPACITOR .056μF 600V	72136	6-11017	11
					12
					13
A5R1	RS-7-.62Ω-5%	RESISTOR .62Ω 7W 5%	91637	5-50209	14
A5R2	RS-7-2.5Ω-5%	RESISTOR 2.5Ω 7W 5%	91637	5-50207	15
A5R3	RS-7-10Ω-5%	RESISTOR 10Ω 7W 5%	91637	5-50208	16
A5R4	RS-7-40Ω-5%	RESISTOR 40Ω 7W 5%	91637	5-50210	17
					18
					19
					20
	8788	STANDOFF	83330	2-10599	21
					22
					23
					24
	6-32 UNC x3/8LG	SCREW, PAN HEAD	81349		25
	#6	WASHER, STAR INT.	81349		26
					27
					28
					29
	#12 AWG	BUSS WIRE			30
					31
					32
					33
					34
					35
					36

MODEL	2501T	CALICO P/N	4250-404	ASSY R.D.
TITLE	OUTPUT SELECTOR ASSEMBLY	SHT 3	OF 3	A5

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A1	4250-700-1	P.C. BOARD ASSY	16067		1
	-7	P.C. BOARD MECH.	16067	1-60261	2
					3
		EYELET (SEE SHEET 3)			4
					5
A1C1	T362B106M025AS	CAPACITOR 10μF 25V	05397	6-10738	6
A1C2	CM05E470J03	CAPACITOR 47PF 500V	81349	6-10268	7
A1C3	1DP-3-154K	CAPACITOR .15μF 100V	72136	6-10478	8
A1C4	TBD	CAPACITOR			9
A1C5	TG-P10	CAPACITOR .1μF 100V	56289	6-10127	10
A1C6	39D257F100GPA	CAPACITOR 250μF 100V	56289	6-10743	11
A1C7	CK103	CAPACITOR .01μF 50V	71590	6-10094	12
A1C8	TVA-1441	CAPACITOR 10μF 200V	56289	6-11020	13
A1C9	DM15-F-251K	CAPACITOR 250PF 500V	72136	6-10620	14
A1C10	TG-P10	CAPACITOR .1μF 100V	56289	6-10127	15
A1C11	39D257F100GPA	CAPACITOR 250μF 100V	56289	6-10743	16
A1C12	DM15-F-251K	CAPACITOR 250PF 500V	72136	6-10620	17
A1C13	TVA-1443	CAPACITOR 50μF 200V	56289	6-11021	18
A1C14	T362B225M025AS	CAPACITOR 2.2μF 25V	05397	6-10798	19
A1C15	T362B225M025AS	CAPACITOR 2.2μF 25V	05397	6-10798	20
A1C16	CK 102	CAPACITOR .1000PF50V	71590	6-10459	21
A1C17	CM05F101J03	CAPACITOR 100PF 500V	81349	6-10027	22
A1C18	CM05F101J03	CAPACITOR 100PF 500V	81349	6-10027	23
A1C19	T362D107M020AS	CAPACITOR 100μF 20V	05397	6-10863	24
A1C20	T362B475M025AS	CAPACITOR 4.7μF 25V	05397	6-10802	25
A1C21	CK 503	CAPACITOR .05μF 50V	71590	6-10460	26
A1C22	TG-D50	CAPACITOR .005μF 100V	56289	6-10770	27
A1C23	CK 503	CAPACITOR .05μF 50V	71590	6-10460	28
A1C24	TG-D50	CAPACITOR .005μF 100V	56289	6-10770	29
A1C25	CK 503	CAPACITOR .05μF 50V	71590	6-10460	30
A1C26	TG-D50	CAPACITOR .005μF 100V	56289	6-10770	31
A1C27	CK 102	CAPACITOR 1000PF 50V	71590	6-10459	32
A1C28	Z1A474G	CAPACITOR .47μF 2% 100V	12406	6-11022	33
A1C29	CK 102	CAPACITOR 1000PF 50V	71590	6-10459	34
A1C30	Z1A474G	CAPACITOR .47μF 2% 100V	12406	6-11022	35
A1C31	T362A226M015AS	CAPACITOR 22μF 15V	05397	6-10967	36

MODEL	2501T/3001T	CALICO P/N	4250-700	ASSY R.D.
TITLE	PREAMPLIFIER AND CONTROL BD ASSY	SHT 4	OF 12	A1

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A1C32	TCA-104Z	CAPACITOR .1μF 25V	02799	6-11007	37
A1C33	CK 102	CAPACITOR 1000PF 50V	71590	6-10459	38
A1C34	Z1A474G	CAPACITOR .47μF 2% 100V	12406	6-11022	39
A1C35	CK 102	CAPACITOR 1000PF 50V	71590	6-10459	40
A1C36	Z1A474G	CAPACITOR .47μF 2% 100V	12406	6-11022	41
A1C37	T362A226M015AS	CAPACITOR 22μF 15V	05397	6-10967	42
A1C38	TCA-104Z	CAPACITOR .1μF 25V	02799	6-11007	43
A1C39	CK 102	CAPACITOR 1000PF 50V	71590	6-10459	44
A1C40	Z1A474G	CAPACITOR .47μF 2% 100V	12406	6-11022	45
A1C41	CK 102	CAPACITOR 1000PF 50V	71590	6-10459	46
A1C42	Z1A474G	CAPACITOR .47μF 2% 100V	12406	6-11022	47
A1C43	T362B475M025AS	CAPACITOR 4.7μF 25V	05397	6-10802	48
A1C44	T362A105M050AS	CAPACITOR 1μF 50V	05397	6-10760	49
A1C45	BR1000-50	CAPACITOR 1000μF 50V	14655	6-10529	50
A1C46	CK 103	CAPACITOR .01μF 50V	71590	6-10094	51
A1C47	CK 102	CAPACITOR 1000PF 50V	71590	6-10459	52
A1C48	TCA-104Z	CAPACITOR .1μF 25V	02799	6-11007	53
A1C49	CK 103	CAPACITOR .01μF 50V	71590	6-10094	54
A1C50	CK 102	CAPACITOR 1000PF 50V	71590	6-10459	55
A1C51	TCA-104Z	CAPACITOR .1μF 25V	02799	6-11007	56
A1C52	CK 103	CAPACITOR .01μF 50V	71590	6-10094	57
A1C53	CK 102	CAPACITOR 1000PF 50V	71590	6-10459	58
A1C54	TCA-104Z	CAPACITOR .1μF 25V	02799	6-11007	59
A1C55	CK 103	CAPACITOR .01μF 50V	71590	6-10094	60
A1C56	CK 102	CAPACITOR 1000PF 50V	71590	6-10459	61
A1C57	TCA-104Z	CAPACITOR .1μF 25V	02799	6-11007	62
A1C58	CK 103	CAPACITOR .01μF 50V	71590	6-10094	63
A1C59	CK 102	CAPACITOR 1000PF 50V	71590	6-10459	64
A1C60	TCA-104Z	CAPACITOR .1μF 25V	02799	6-11007	65
A1C61	CK 103	CAPACITOR .01μF 50V	71590	6-10094	66
A1C62	CK 102	CAPACITOR 1000PF 50V	71590	6-10459	67
A1C63	T362C107M006AS	CAPACITOR 100μF 6V	05397	6-10816	68
A1C64	T362C107M006AS	CAPACITOR 100μF 6V	05397	6-10816	69
A1C65	TCA-104Z	CAPACITOR .1μF 25V	02799	6-11007	70
A1C66	T362A226M015AS	CAPACITOR 22μF 15V	05397	6-10967	71
A1C67	TCA-104Z	CAPACITOR .1μF 25V	02799	6-11007	72

MODEL	2501T/3001T	CALICO P/N 4250-700	ASSY R.D.
TITLE	PREAMPLIFIER AND CONTROL BD ASSY	SHT 5 OF 12	A1

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A1C68	T362A226M015AS	CAPACITOR 22μF 15V	05397	6-10967	73
A1C69	1-DP-1-223K	CAPACITOR .022μF 100V	72136	6-10531	74
A1C70	TCA-104Z	CAPACITOR .1μF 25V	02799	6-11007	75
A1C71	TBD	CAPACITOR			76
A1C72	T362B475M025AS	CAPACITOR 4.7μF 25V	05397	6-10802	77
					78
					79
					80
					81
A1CR1	1N5237B	DIODE, ZENER	04713	3-10251	82
A1CR2	1N5235B	DIODE, ZENER	04713	3-10196	83
A1CR3	1N914	DIODE	07910	3-10118	84
A1CR4	1N914	DIODE	07910	3-10118	85
A1CR5	1N914	DIODE	07910	3-10118	86
A1CR6	1N914	DIODE	07910	3-10118	87
A1CR7	1N914	DIODE	07910	3-10118	88
A1CR8	1N4001	DIODE	04713	3-10172	89
A1CR9	1N4001	DIODE	04713	3-10172	90
A1CR10	1N4002	DIODE	04713	3-10162	91
A1CR11	1N4002	DIODE	04713	3-10162	92
A1CR12	1N5242B	DIODE, ZENER	04713	3-10206	93
A1CR13	1N914	DIODE	07910	3-10118	94
A1CR14	1N914	DIODE	07910	3-10118	95
A1CR15	1N914	DIODE	07910	3-10118	96
A1CR16	1N914	DIODE	07910	3-10118	97
A1CR17	1N914	DIODE	07910	3-10118	98
A1CR18	1N914	DIODE	07910	3-10118	99
A1CR19	1N914	DIODE	07910	3-10118	100
A1CR20	1N914	DIODE	07910	3-10118	101
A1CR21	1N914	DIODE	07910	3-10118	102
A1CR22	1N4002	DIODE	04713	3-10162	103
A1CR23	1N5242B	DIODE, ZENER	04713	3-10206	104
A1CR24	1N914	DIODE	07910	3-10118	105
A1CR25	1N914	DIODE	07910	3-10118	106
A1CR26	1N914	DIODE	07910	3-10118	107
A1CR27	1N914	DIODE	07910	3-10118	108

MODEL	2501T/3001T	CALICO P/N	4250-700	ASSY R.D.
TITLE	PREAMPLIFIER AND CONTROL BD ASSY	SHT 6	OF 12	A1

CALIFORNIA INSTRUMENTS CO. SAN DIEGO, CALIFORNIA	CODE IDENT 16067	PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A1CR28	1N914	DIODE	07910	3-10118	109
A1CR29	1N914	DIODE	07910	3-10118	110
A1CR30	1N4002	DIODE	04713	3-10162	111
A1CR31	1N4002	DIODE	04713	3-10162	112
					113
					114
					115
					116
A1IC1	LM741CN	INTEGRATED CIRCUIT	27014	3-60030	117
A1IC2	LM741CN	INTEGRATED CIRCUIT	27014	3-60030	118
A1IC3	LM741CN	INTEGRATED CIRCUIT	27014	3-60030	119
A1IC4	LM741CN	INTEGRATED CIRCUIT	27014	3-60030	120
A1IC5	NE555V	INTEGRATED CIRCUIT	18324	3-60026	121
A1IC6	NE555V	INTEGRATED CIRCUIT	18324	3-60026	122
A1IC7	NE555V	INTEGRATED CIRCUIT	18324	3-60026	123
A1IC8	NE555V	INTEGRATED CIRCUIT	18324	3-60026	124
A1IC9	NE555V	INTEGRATED CIRCUIT	18324	3-60026	125
A1IC10	NE555V	INTEGRATED CIRCUIT	18324	3-60026	126
A1IC11	NE555V	INTEGRATED CIRCUIT	18324	3-60026	127
A1IC12	NE555V	INTEGRATED CIRCUIT	18324	3-60026	128
A1IC13	NE555V	INTEGRATED CIRCUIT	18324	3-60026	129
A1IC14	NE555V	INTEGRATED CIRCUIT	18324	3-60026	130
A1IC15	NE555V	INTEGRATED CIRCUIT	18324	3-60026	131
A1IC16	NE555V	INTEGRATED CIRCUIT	18324	3-60026	132
A1IC17	LM741CN	INTEGRATED CIRCUIT	27014	3-60030	133
A1IC18	MC7815-15CP	INTEGRATED CIRCUIT	04713	3-60135	134
					135
A1L1	1537-90	INDUCTOR 200μH	99800	5-90005	136
A1L2	1537-90	INDUCTOR 200μH	99800	5-90005	137
					138
					139
					140
A1Q1	CA3096AE	TRANSISTOR ARRAY	95303	3-30252	141
A1Q2	2N5415	TRANSISTOR	95303	3-30141	142
A1Q3	2N5415	TRANSISTOR	95303	3-30141	143
A1Q4	2N3440	TRANSISTOR	95303	3-30090	144

MODEL	2501T/3001T	CALICO P/N 4250-700		ASSY R.D.
TITLE	PREAMPLIFIER AND CONTROL BD ASSY		SHT 7 OF 12	A1

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A1Q5	2N5172	TRANSISTOR	56289	3-30219	145
A1Q6	2N5087	TRANSISTOR	04713	3-30204	146
A1Q7	2N3440	TRANSISTOR	95303	3-30090	147
A1Q8	2N5415	TRANSISTOR	95303	3-30141	148
A1Q9	2N3440	TRANSISTOR	95303	3-30090	149
A1Q10	2N3440	TRANSISTOR	95303	3-30090	150
A1Q11	2N5415	TRANSISTOR	95303	3-30141	151
					152
					153
					154
					155
					156
					157
A1R1	RN60C1002F	RESISTOR 10K 1%	81349	5-60081	158
A1R2	RC07GF474J	RESISTOR 470K 1/4W 5%	81349	5-10115	159
A1R3	RC07GF103J	RESISTOR 10K 1/4W 5%	81349	5-10076	160
A1R4	RN60D8662F	RESISTOR 86.6K 1%	81349	5-60126	161
A1R5	RC07GF101J	RESISTOR 100Ω 1/4W 5%	81349	5-10029	162
A1R6	TBD	RESISTOR			163
A1R7	RC07GF100J	RESISTOR 10Ω 1/4W 5%	81349	5-10005	164
A1R8	NOT USED	RESISTOR			165
A1R9	RN60D7501F	RESISTOR 7.5K 1%	81349	5-60067	166
A1R10	RN60D7501F	RESISTOR 7.5K 1%	81349	5-60067	167
A1R11	RC07GF222J	RESISTOR 2.2K 1/4W 5%	81349	5-10060	168
A1R12	RN55D1000F	RESISTOR 100 Ω 1%	81349	5-60684	169
A1R13	X-201R101	POTENTIOMETER 100Ω	71450	5-70153	170
A1R14	RN55D1000F	RESISTOR 100 Ω 1%	81349	5-60684	171
A1R15	RC07GF512J	RESISTOR 5.1K 1/4W 5%	81349	5-10069	172
A1R16	RN60C3571F	RESISTOR 3.57K 1%	81349	5-60714	173
A1R17	RC07GF222J	RESISTOR 2.2K 1/4W 5%	81349	5-10060	174
A1R18	RC07GF752J	RESISTOR 7.5K 1/4W 5%	81349	5-10073	175
A1R19	RC07GF752J	RESISTOR 7.5K 1/4W 5%	81349	5-10073	176
A1R20	RC07GF622J	RESISTOR 6.2K 1/4W 5%	81349	5-10071	177
A1R21	RC07GF622J	RESISTOR 6.2K 1/4W 5%	81349	5-10071	178
A1R22	RC07GF102J	RESISTOR 1K 1/4W 5%	81349	5-10053	179
A1R23	RC07GF102J	RESISTOR 1K 1/4W 5%	81349	5-10053	180

MODEL	2501T/3001T	CALICO P/N	4250-700		ASSY R.D.
TITLE	PREAMPLIFIER AND CONTROL BD. ASSY			SHT 8 OF 12	A1

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A1R96	RC07GF473J	RESISTOR 47K 1/4W 5%	81349	5-10092	253
A1R97	RN60C1652F	RESISTOR 16.5K 1%	81349	5-60638	254
A1R98	RG07GF512J	RESISTOR 5.1K 1/4W	81349	5-10069	255
A1R99	RC07GF103J	RESISTOR 10K 1/4W 5%	81349	5-10076	256
A1R100	RN60C7321F	RESISTOR 7.32K 1%	81349	5-60243	257
A1R101	X-201R252B	POTENTIOMETER 2.5K	81349	5-70177	258
A1R102	RN60C6192F	RESISTOR 61.9K 1%	81349	5-60436	259
A1R103	RC07GF103J	RESISTOR 10K 1/4W 5%	81349	5-10076	260
A1R104	RC07GF470J	RESISTOR 47Ω 1/4W 5%	81349	5-10021	261
A1R105	RC07GF393J	RESISTOR 39K 1/4W 5%	81349	5-10090	262
A1R106	RC07GF470J	RESISTOR 47Ω 1/4W 5%	81349	5-10021	263
A1R107	RC07GF393J	RESISTOR 39K 1/4W 5%	81349	5-10090	264
A1R108	RC07GF470J	RESISTOR 47Ω 1/4W 5%	81349	5-10021	265
A1R109	RC07GF393J	RESISTOR 39K 1/4W 5%	81349	5-10090	266
A1R110	RC07GF470J	RESISTOR 47Ω 1/4W 5%	81349	5-10021	267
A1R111	RC07GF393J	RESISTOR 39K 1/4W 5%	81349	5-10090	268
A1R112	RC07GF470J	RESISTOR 47Ω 1/4W 5%	81349	5-10021	269
A1R113	RC07GF393J	RESISTOR 39K 1/4W 5%	81349	5-10090	270
A1R114	RC07GF470J	RESISTOR 47Ω 1/4W 5%	81349	5-10021	271
A1R115	RC07GF393J	RESISTOR 39K 1/4W 5%	81349	5-10090	272
A1R116	RC07GF103J	RESISTOR 10K 1/4W 5%	81349	5-10076	273
A1R117	RG07GF512J	RESISTOR 5.1K 1/4W 5%	81349	5-10069	274
A1R118	NOT USED				275
A1R119	RC07GF333J	RESISTOR 33K 1/4W 5%	81349	5-10088	276
A1R120	RC07GF203J	RESISTOR 20K 1/4W 5%	81349	5-10083	277
A1R121	RC07GF203J	RESISTOR 20K 1/4W 5%	81349	5-10083	278
A1R122	RC07GF203J	RESISTOR 20K 1/4W 5%	81349	5-10083	279
A1R123	RC07GF203J	RESISTOR 20K 1/4W 5%	81349	5-10083	280
A1R124	RC07GF203J	RESISTOR 20K 1/4W 5%	81349	5-10083	281
A1R125	RC07GF203J	RESISTOR 20K 1/4W 5%	81349	5-10083	282
A1R126	TBD	RESISTOR			283
					284
					285
					286
					287
					289

MODEL	2501T	CALICO P/N	4250-700	ASSY R.D.
TITLE	PREAMPLIFIER AND CONTROL BD ASSY	SHT 11 OF 12		A1

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A1T1	T31-X	TRANSFORMER	81095	7-10130	289
A1T2	4250-014-1	SCR DRIVE XFMR	16067	7-10291	290
A1T3	4250-014-1	SCR DRIVE XFMR	16067	7-10291	291
A1T4	4250-014-1	SCR DRIVE XFMR	16067	7-10291	292
A1T5	4250-014-1	SCR DRIVE XFMR	16067	7-10291	293
A1T6	4250-014-1	SCR DRIVE XFMR	16067	7-10291	294
A1T7	4250-014-1	SCR DRIVE XFMR	16067	7-10291	295
					296
					297
					298
	TXBF-032-025B	HEATSINK	98978	2-40120	299
	RCT05075-7A	TRANSIPAD T0-5	19080	2-40296	300
	3237	BRACKET	06540	1-10596	301
	PA2-1CB	HEATSINK	98978	2-10497	302
	B118 (PLASTIC 12"	BINDING BARS, NATURAL	0000P		303
	N4-40 x 5/8	SCREW, NYLON	95987	2-10141	304
					305
	N4-40 - X	NUT, NYLON, HEX	95987	2-10136	306
	6-32 x 7/16	SCREW			307
	6-32	NUT, HEX			308
	#6	WASHER, STAR INT			309
	4-40 -1/4	SCREW			310
	4-40	NUT, HEX			311
	#4	WASHER, STAR INT.			312
	2520B-1	TERMINAL	88245	2-50256	313
					314
	WRN 5-1/2	WIRE TIE	51705		315
	4-40-3/8	SCREW			316
					317
	22 AWG	BUSS WIRE			318
	22 GA	TEFLONG SLEEVING 1000V			319

MODEL	2501T/3001T	CALICO P/N	4250-700	ASSY R.D.
TITLE	PREAMPLIFIER AND CONTROL BD ASSY	SHT 12	OF 12	A1

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A7	4250-704-1	P.C. BOARD ASSEMBLY	16067		1
	4250-704-7	P.C. BOARD MECHANICAL	16067	1-60259	2
	SEE SHEET 3	EYELET			3
					4
					5
A7C1 THRU A7C4		NOT USED			6
A7C5	5HK-P10	CAPACITOR . 1μF 500V	56289	6-10821	7
A7C6	5HK-P10	CAPACITOR . 1μF 500V	56289	6-10821	8
					9
					10
					11
A7CR1	1N4001	DIODE	04713	3-10172	12
A7CR2	1N4001	DIODE	04713	3-10172	13
					14
					15
					16
A7R1	4409A	RESISTOR 450Ω 3-1/4 W	44655	5-50212	17
A7R2	4420	RESISTOR 820Ω 3-1/4 W	44655	5-50213	18

MODEL	2501T	CALICO P/N	4250-704	ASSY R.D.
TITLE	CAPACITOR BUSS BOARD ASSEMBLY	SHT 4	OF 4	A7

CALIFORNIA INSTRUMENTS CO.
SAN DIEGO, CALIFORNIA

CODE IDENT 16067

PARTS LIST

REF. DES.	MFG. NUMBER	DESCRIPTION	CODE IDENT	CALICO STOCK NUMBER	ITEM NO.
A6	4050-702-1	VOLTMETER BD. ASSY	16067		1
	-7	P.C. BOARD	16067	1-57003	2
		EYELET (SEE SHEET 3)			3
A6	4050-702-2	VOLTMETER BD. ASSY	16067		4
A6	4050-702-3	VOLTMETER BD. ASSY.	16067		5
					6
A6CR1	1N914	DIODE	JEDEC	3-10118	7
A6CR2	1N914	DIODE	JEDEC	3-10118	8
A6CR3	1N914	DIODE	JEDEC	3-10118	9
A6CR4	1N914	DIODE	JEDEC	3-10118	10
					11
					12
A6R1B	ET34X502	POTENTIOMETER 5K	30983	5-70132	13
A6R1A	U-201R502	POTENTIOMETER 5K	71450	5-75036	14
A6R2	RC07GF102J	RESISTOR 1K 1/4W 5%	JEDEC	5-10053	15
A6R3	RC07GF682J	RESISTOR 6.8K 1/4W 5%	JEDEC	5-10072	16
A6R4	RC07GF272J	RESISTOR 2.7K 1/4W 5%	JEDEC	5-10062	17
A6R5	RC07GF911J	RESISTOR 910Ω 1/4W 5%	JEDEC	5-10052	18
A6R6	RN60C3322F	RESISTOR 33.2K 1/8W 1%	JEDEC	5-60249	19
A6R7	RN70C2673F	RESISTOR 267K 1/2W 1%	JEDEC	5-60330	20
A6R8	RN60C1333F	RESISTOR 133K 1/8W 1%	JEDEC	5-60329	21
A6R9	RN60C6652F	RESISTOR 66.5K 1/8W 1%	JEDEC	5-60399	22
					23
					24
					25
					26
					27
					28
					29
					30
					31
					32
					33
					34
					35
					36

MODEL 501T | CALICO P/N 4050-702 | ASSY R.D. A6

TITLE VOLTMETER P.C. BOARD ASSEMBLY | SHT 4 OF 4

APPENDIX A

The following code numbers are from the Federal Supply Code for Manufacturers Cataloging Handbook H4-1 and its latest supplement. Alphabetical codes have been arbitrarily assigned to suppliers not appearing in the H4 Handbook

0000A	ElectriCord	Westfield	PA
000AA	OK Machine and Tool Corp.	New York	NY
000AB	Falmat	Harbor City	CA
0000B	Tech. Prod. Sales	Sorrento Valley	CA
0000C	Jackson Bros.	Waddon, Surrey	GB
0000D	Chicago Std. Transformer Co	Chicago	IL
0000E	Use Code #08289		
0000F	Colvern	Santa Monica	CA
0000G	Use Code #30983		
0000H	Mial of Italy c/o Q C Components	Los Angeles	CA
00001	Use Code #50522		
0000J	Use Code #34333		
0000K	Elma	Schweis	GE
0000L	Use Code #32293		
0000M	Use Code #16950		
0000N	Use Code #15912		
0000P	Mesa Office Supply	San Diego	CA
0000R	American Handle	Philadelphia	PA
0000S	OPCDA	Edison	NJ
0000T	Use Code #31743		
0000U	Use Code #32293		
0000V	Falmat	Los Angeles	CA
0000W	Miltron Ross Co.	Southampton	PA
0000X	Use Code #52072		
0000Y	Use Code #29990		
0000Z	Timco	Los Angeles	CA
00141	Pic Design Corp.	E. Rockaway	NY
00194	Walsco Electronics Corporation	Los Angeles	CA
00544	Metal-Cal Div., Avery Prod. Corp.	Inglewood	CA
00656	Aerovox Corporation	New Bedford	MA
00779	AMP, Inc.	Harrisburg	PA
00853	Sangamo Electric Company	Pickens	SC
00866	Goe Eng. Co., Inc.	City of Industry	CA
01121	Allen-Bradley Company	Milwaukee	WI
01179	Ajax Magnethermic Corp.	NE Warren	OH
01255	Litton Industries, Inc.	Beverly Hills	CA
01281	T R W Semiconductors, Inc	Lawndale	CA
*01295	Texas Instruments, Inc.	Dallas	TX
02111	Spectrol Electronics	City of Industry	CA
02114	Ferroxcube Corp.	Saugerties	NY
02335	Fairchild Controls Corp	Hicksville, LI	NY
02660	Amphenol Corporation	Broadview	IL
02799	Use Code #72136		
03507	General Electric Company	Syracuse	NY
03508	General Electric Company	Syracuse	NY
03516	General Electric Company	Somersworth	NH
03797	Eldema Corporation	Compton	CA
03888	Pyrofilm Resistor Co., Inc	Cedar Knolls	NJ
03911	Clairex Corporation	New York	NY
04009	Arrow-Hart and Hegeman Elec Co	Hartford	CT
04062	Use Code #72136		
04713	Motorola Semiconductor Prod., Inc.	Phoenix	AZ
04963	3-M	St. Paul	MN
05236	Jonathan Mfg. Co.	Fullerton	CA
05276	Pomona Electronics Co., Inc	Pomona	CA
05347	Ultronix	Grand Junction	CO
05397	Kemet, Union Carbide Corp	Cleveland	OH
05820	Wakefield Engineering, Inc.	Wakefield	MA
06046	Dixeon Meter	Grand Junction	CO
06184	Conelco Components	San Bernadino	CA
06223	Kooltronic Fan Company	Princeton	NJ
06229	Electrovert, Incorporated	Mt. Vernon	NY
06383	Panduit Corp.	Tinley Park	IL
06514	Stantron, Wyco Metal Products	N. Hollywood	CA
06540	Amathom Elect. Hardward	New Rochelle	NY
06682	Magnetic Shield Div.	Chicago	IL
06776	Robinson, Nugent, Inc	New Albany	IN
06915	Richco Plastics, Co.	Chicago	IL
07088	Kelvin Electric Company	Van Nuys	CA
07115	Use Code #14674		
07256	Silicon Transistor Corp.	Garden City	NY
07263	Fairchild Camera and Instr Corp.	Mt. View	CA
07387	Birtcher Corporation	Los Angeles	CA
07556	Unitrack Calabro Plastics	Upper Darby	PA
07633	Epoxy Prod. Co. Div. of Allied Prod. Corp.	New Haven	CT
07713	Sperry Rand Corporation	Norwalk	CT
07716	I R C Incorporated	Burrington	IA
07910	Continental Devices	Hawthorne	CA
08065	Accurate Rubber and Plastics Co	San Diego	CA
08261	Spectra Strip	Garden Grove	CA
08289	Blina-Delbert Co. Inc.	Pomona	CA
08594	Eimac Div. of Varian Associates	Salt Lake	UT
08718	Use Code #71468		
08730	Vemaline Products Co.	Franklin Lakes	NJ
09026	Babcock Electronics Corp.	Costa Mesa	CA
09145	Atohm, Technical Industries, Inc	Burbank	CA
09353	C and K Components, Inc.	Newton	MA
11432	Diamond Metal Sales	Gardena	CA
11815	Cherry Rivet Div., Townsend Co.	Santa Ana	CA
12020	Ovenaire, Incorporated	Charlottesville	VA
12143	Bendix Corporation	Santa Ana	CA
12405	Hysol Corporation	El Monte	CA
12406	Elpac, Incorporated	Fullerton	CA
12463	Omtronics Mfg., Incorporated	Omaha	NE
12673	Wesco Electrical Co.	Greenfield	MA
12697	Clarostat Mfg. Co., Incorporated	Dover	NH
13103	Thermalloy Company	Dallas	TX
13454	Texas Crystals	River Grove	IL
13571	Electronic Research	Overland Park	KS
13919	Burr-Brown Research Corp	Tucson	AS
14099	Semtech Corporation	Newbury Park	CA
14193	Cal-R Inc.	Santa Monica	CA
14604	Elmwood Sensors Inc.	Cranston	RI
14655	Cornell-Dubilier Elect. Corp.	Newark	NJ
14674	Corning Glass Works	Corning	NY
14726	Hollingsworth Co.	Phoenixville	PA
14752	Electro Cube, Incorporated	San Gabriel	CA
14907	Cramer Div. of Conrac	Old Saybrook	CT
15112	Electra Scientific Corporation	Fullerton	CA
15636	Elec-trol	Northridge	CA
15801	Fenwall Electronics	Framingham	MA
15818	Amelco Teledyne, Incorporated	Mt. View	CA
15909	Use Code #17870		
15912	Ansley	Los Angeles	CA
16067	California Instruments Company	San Diego	CA
16758	Delco Radio Div., General Motors	Kokomo	IN
16795	Bristol Electronics Inc.	Bedford	MA
16902	Simpson Instruments, Inc	Escondido	CA
16950	Precision Dynamics Corp.	Burbank	CA
16956	Dennison	Framingham	MS
17745	Angstrohm Precision, Inc.	Van Nuys	CA
17838	Mektron, California General, Inc.	Chula Vista	CA
17856	Siliconix	Santa Clara	CA
17870	Daven Div., Thomas A. Edison	Manchester	NH
18076	Umpco	City of Industry	CA
18121	Wilshire Foam Products, Inc	Gardena	CA
18178	Vactec Inc.	Maryland Heights	MO
18324	Signatics	Sunnyvale	CA
18612	Vishay Instruments Inc	Malvern	PA
18677	Scambe Mfg. Co.	Monterey Park	CA
18702	Ducommun Metals and Supply Co.	Los Angeles	CA
18722	R C A	Mountaintop	PA
19080	The Robinson Company	Hawthorne	CA
19781	Potter Company	Sun Valley	CA
20857	South Bay Cable Corp.	Gardena	CA
21270	Behr-Manning	Watervliet	NY
21604	Buckeye Stamping Company	Columbus	OH
22045	Jordan Elect.	Van Nuys	CA
22599	Elastic Stop Nut Corporation	Van Nuys	CA
23039	Deccofelt Products Company	Glendora	CA
23050	Product Components Corp.	Hastings-on-Hudson	NY
23095	Aztec Electronics In.	Anaheim	CA
23783	British Radio Electric Ltd	Washington	DC
23936	Pamotor, Incorporated	San Francisco	CA
24011	E C C	Burlington	MA
24655	General Radio	Concord	MA
24796	Parelco Inc.	Paramount	CA
24931	Specialty Connector Co., Inc.	Indianapolis	IN
25403	Amperex (Diodes)	Slaterville	RI
25684	Victoreen Instrument Co., Inc.	Oak Lawn	IL
25706	Daburn Electronics and Cable Corp.	New York	NY
*01963	Cherry Electronical Prod Corp	Waukegan	IL
26528	Lamcor Incorporated	Anaheim	CA
26533	Use Code #98376		
26806	American Zettler Inc.	Costa Mesa	CA
27014	National Semi-Conductor Corp	Santa Clara	CA
27191	Cutler-Hammer, Inc	Milwaukee	WI
27264	Molex	Downers Grove	IL
27556	IMB Electronic Products	Santa Fe Springs	CA
27683	Varo, Incorporated	St. Garland	TX
27832	Hughes Aircraft	Newport Beach	CA
28480	Hewlett-Packard Co.	Palo Alto	CA
*28520	Heyman Mfg. Company (Heyco)	Kenilworth	NJ
30086	I-T-E Circuit Breaker Co	Philadelphia	PA
30817	Instrument Specialties Co	Little Falls	NJ
30897	Dorann Co.	Sylmar	CA
30983	Electra/Midland (Mepco/Electra)	San Diego	CA
31743	Elpower	Santa Ana	CA
31951	Tridge Inc	Pittsburgh	PA
32293	Interail	Cupertino	CA
34333	Silicon General	Westminister	CA
34649	Intel Corp	Santa Clara	CA
35929	Constanta	Quebec	CN
42190	Muter Company	Chicago	IL
44655	Ohmite Manufacturing Company	Skokie	IL
45722	Parker-Kalon	Clifton	NJ
46384	Penn. Eng. and Mfg Corp.	Doylestown	PA
49956	Raytheon Co.	Lexington	MA
50522	Monsanto, Electronic Special Products	Cupertino	CA
50558	Electronic Concepts Inc.	Eatontown	NJ
51705	ICO/Rally	Palo Alto	CA
52072	Circuit Assembly Corp.	Costa Mesa	CA
53209	W H Brady Co	Milwaukee	WI
56289	Sprague Electric Company	North Adams	MA
57771	Stimson	Bayport	NY
58474	Superior Electric Company	Bristol	CT
59730	Thomas and Betts Company	Elizabeth	NJ
60741	Triplett Electrical Instrument Co	Bluffton	OH
63743	Ward Leonard Electric Co	Mt. Vernon	NY
70318	Allmetal Screw Prod. Co.	Garden City	NY
70903	Belden Manufacturing Co	Chicago	IL
71002	Birnbach Radio Company Inc	New York	NY
71218	Bud Radio	Willoughby	OH
71279	Cambridge Thermionic Corp.	Cambridge	MA
71400	Bussman Mfg. Div. McGraw-Edison Co	St. Louis	MO
71450	CTS Corporation	Elkhart	IN
71468	ITT Cannon Electric Inc.	Los Angeles	CA
71590	Centralab Div Globe-Union Inc	Milwaukee	WI
71707	Coto-Coil	Providence	RI
71744	Chicago Miniature Lampworks	Chicago	IL
71785	Cinch Manufacturing Company	Chicago	IL
72136	Elmenco (Electro Motive)	Willimantic	CT
72259	Nytronics Incorporated	Pelham Manor	NY
72619	Dialight Corporation	Brooklyn	NY
72699	General Instruments	Newark	NJ
72982	Erie Technological Products, Inc.	Erie	PA
73138	Beckman Instruments, Inc	Fullerton	CA
73445	Amperex (Capacitors)	Long Island	NY
73559	Carling Electric, Inc.	West Hartford	CT
73734	Federal Screw Products, Inc	Chicago	IL
73899	J F D Electronics Company	Brooklyn	NY
73949	Guardian Electric Mfg. Co.	Chicago	IL
73957	Groov-Pin Corporation	Ridgefield	NJ
74193	Heinemann Electric Company	Trenton	NJ
74276	Signalite, Incorporated	Neptune	NJ
74542	Hoyt Electrical Instrument Works	Penacook	NH
74545	Harvey Hubbel, Inc	Bridgeport	CT
74970	E. F. Johnson Company	Waseca	MN
75382	Kulka Electric Corporation	Mt. Vernon	NY
75915	Littlefuse Incorporated	Des Plaines	IL
75987	Use Code #95987		
76055	Mallory Controls	Frankfort	IN
76348	Miller Products Company	New York	NY
76385	Minor Rubber Co.	Bloomfield	NJ
76493	J. W. Miller Company	Los Angeles	CA
76854	Oak Manufacturing Company	Crystal Lake	IL
77342	Potter and Brumfield Div., Amer Machine and Foundry Company	E. Princeton	IN
77638	General Instruments	Brooklyn	NY
77969	Rubber Craft Corp. of California	Torrance	CA
78189	Shakeproof Div., Illoms Tool Works	Chicago	IL
78299	Struthers-Dunn, Incorporated	Pitman	NJ
78488	Stackpole Carbon Company	St. Marys	PA
78526	Stanwych Winding Company, Inc.	Newburgh	NY
78553	Tinnerman Products, Inc	Cleveland	OH
78947	Ucinite Company	Newtonville	MA
79130	Johns-Manville Products Corp.	Chicago	IL
79727	Continental-Wirt Electronics Corp.	Warminister	PA
79963	Zierick Mfg. Corporation	New Rochelle	NY
80031	Mepco/Electra	Morristown	NJ
80112	G. C. Electronics Company	Los Angeles	CA
80223	United Transformer Co.	New York	NY
80294	Bourns, Incorporated	Riverside	CA
80368	Sylvania Electric Products, Inc.	New York	NY
80583	Hammarlund Mfg Co.	Red Bank	NJ
81073	Grayhill, Incorporated	La Grange	IL
81095	Triad Transformer Corp.	Venice	CA
81312	Winchester Electronics	Oakville	CT
81349	Military Spec., Standardization Division Directorate of Logistic Services DSA		
82104	Standard Grigsby	Aurora	IL
82389	Switchcraft, Incorporated	Chicago	IL
82877	Rotron Manufacturing Co. Inc	Woodstock	NY
82893	Vector Electronics Inc.	Sylmar	CA
83058	Car Fastener Company	Cambridge	MA
83125	Nytronics Inc. Cap Division	Darlington	SC
83324	Rosan, Incorporated	Newport Beach	CA
83330	Herman H Smith, Inc.	Brooklyn	NY
83594	Burrough Corporation	Plainfield	NJ
83701	Electronic Devices Incorporated	Yonkers	NY
83781	Natl. Electronics	Geneva	IL
83827	Resistors Inc.	Chicago	IL
84171	Arco Electronics Inc	Great Neck	NY
86684	R C A	Harrison	NJ
86928	Seastrom Mfg. Co.	Glendale	CA
87034	Marco-Oak Industries	Anaheim	CA
88026	Use Code #27191		
88245	Useco Div., Litton Industries	Van Nuys	CA
89536	Fluke	Seattle	WA
90030	USM Corp.	Beverly	MA
90201	Mallory Capacitor Company	Indianapolis	IN
91459	Alcon Metal Prod Inc	Chicago	IL
91506	Augat	Attlebord	MA
91637	Dale Electronics, Inc.	Columbus	NE
91662	Elco Corporation	Willow Grove	PA
91812	Janco Corporation	Burbank	CA
91833	Keystone Electronics Corp.	New York	NY
91929	Micro Switch Div., Honeywell, Inc	Freeport	IL
92194	Alpha Wire Corporation	Elizabeth	NJ
92219	Waldom Electronics, Inc.	Chicago	IL
93332	Sylvania Electric Products Inc.	Woburn	MA
94222	Southco, Incorporated	Lester	PA
95146	Alco Electronics Products	Lawrence	MA
95303	R C A	Cincinnati	OH
95348	Gordos Corp.	Bloomfield	NJ
95416	Use Code #95146		
95987	Weckesser Company, Inc	Chicago	IL
96682	Genisco, Incorporated	Compton	CA
96733	San Fernando Electric Mfg Co.	San Fernando	CA
97525	Electronic Engineering Co.	Santa Ana	CA
97918	Linemaster Switch Corp.	Woodstock	CT
97954	U.S. Components, Incorporated	Bronx	NY
98159	Rubber Teck, Incorporated	Gardena	CA
98278	Microdot, Incorporated (Lerco)	S. Pasadena	CA
98291	Sealectro Corp	Mamaroneck	NY
98376	Zero Mfg. Co (West)	Burbank	CA
98978	IERC	Burbank	CA
99028	Globe	Gardena	CA
99378	Atlee Corp	Woburn	MA
99392	3 M Corporation	Oakland	CA
99515	Marshall Industries	Monrovia	CA
99517	Vacco Industries	El Monte	CA
99742	Permacel Div Johnson and Johnson	New Brunswick	NJ
99743	I M C	Maywood	CA
99800	Delevan Electronics Corporation	Aurora	NY
*29990	American Technical Ceramics	Huntington Station	NY

Revision I
October 26, 1976

ONE YEAR WARRANTY

CALIFORNIA INSTRUMENTS, A NORLIN TECHNOLOGY COMPANY warrants each instrument manufactured by them to be free from defects in material and workmanship for a period of one year from the date of shipment to the original purchaser. Excepted from this warranty are tubes, fuses, and batteries which carry the warranty of their original manufacturer where applicable. CALIFORNIA INSTRUMENTS will service, replace, or adjust any defective part or parts, free of charge, when the instrument is returned to the Company freight prepaid, and when examination reveals that the fault has not occurred because of misuse or abnormal conditions of operation. Equipment repaired beyond the effective date of warranty or when abnormal usage has occurred will be charged at applicable rates. CALIFORNIA INSTRUMENTS will submit an estimate for such charges before commencing repair if so requested.

PROCEDURE FOR SERVICE

If a fault develops, notify CALIFORNIA INSTRUMENTS or its local representative, giving full details of the difficulty, and including the model number and serial number. On receipt of this information, service data or shipping instructions will be furnished. If shipment is indicated, forward the instrument, freight prepaid, to the authorized repair station indicated in the instruction. If requested, an estimate of the charges will be made before the work begins, provided the instrument is not covered by the warranty.

DAMAGE IN TRANSIT

The instrument should be tested as soon as it is received. If it fails to operate properly, or is damaged in any way, a claim should be filed with the carrier. A full report of the damage should be obtained by the claim agent, and this report should be forwarded to us. CALIFORNIA INSTRUMENTS will advise the disposition to be made of the equipment and arrange for repair or replacement. Please include model number and serial number when referring to the instrument.

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